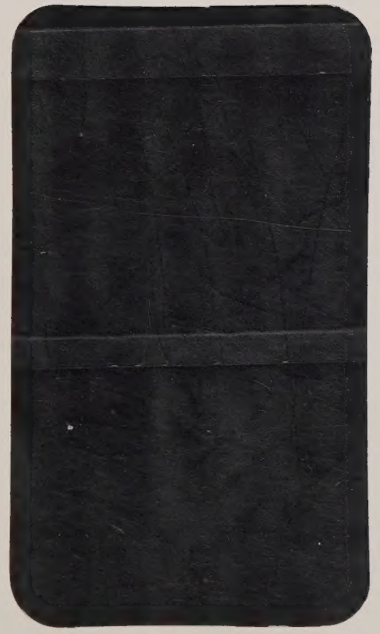
GENERAL ELECTRIC
INSTRUMENTATION & COMMUNICATION
1200 KONA DRIVE
COMPTON, CA 90220

INSTRUCTION MANUAL

CL-6000/6100

ROCHESTER
INSTRUMENT
SYSTEMS



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REPAIR AND MAINTENANCE MANUAL

CL-6000/6100

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INTRODUCTION

The RIS Supercal has been designed to provide years of trouble-free operation. In the event that a malfunction does occur the information contained in this document should aid in troubleshooting and repair of the instrument. Due to the complexity of the instrument it is assumed that repair will only be attempted by qualified, experienced personnel. The most efficient method of troubleshooting from a time standpoint involves circuit card replacement to isolate the fault.

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2.0 THEORY OF OPERATION

2.1 Introduction

The theory of operation of the CL6000 is discussed at two levels. The first, a Functional Description, provides an overview of the calibrator in terms of the functional relationship of the major circuits. The second level, Circuit Description, is a more detailed discussion of the operation of the major circuits. The Circuit Description section contains simplified schematics of these major circuits. Detailed schematic and assembly drawings are provided in Section 7.

2.2 Functional Description (Refer to Figure 1-1)

The CL-6000 Block Diagram shows the major components of the instrument. Input signals (except frequency) are routed through a solid state multiplexer to a buffer amplifier. The buffer output is scaled and routed to a precision analog to digital converter. This converter, controlled by the microprocessor converts the input signal to a digital value, scales it, and displays the result on the Liquid Crystal Display. Frequency input signals are amplified and routed to a counter circuit controlled by the microprocessor. The input terminals, multiplexer, and analog to digital converter are optically isolated from the output and control section. Output signals derived from a digital to analog converter controlled by the microprocessor are routed to the output terminals by a series of solid state switches. The output signals are measured using the same technique as the input signals to insure their accuracy. Instrument power is supplied by internal rechargeable Ni Cad batteries. An external battery charger/power supply is provided with each instrument. The keyboard is a membrane type to provide reliable service in harsh environments. A 2 line, 16 character per line liquid crystal display is utilized for prompting and indication. The microprocessor is a CMOS 1802 and utilizes 1K of static RAM and 16K of EPROM. Precision timing and control is derived from a crystal oscillator and programmable divider circuit. Instrument accuracy is maintained by periodic self-calibration of the input and output sections. When first turned on, an "Auto Cal" cycle is initiated and internal precision reference voltage are read. A software algorithm compares the readings with stored ideal values and determines the corrections required. Once these correction values are determined the instrument indicates "Select Input" "Select Output". To minimize measurement errors while in operation, a calibration cycle is periodically made; however, it is transparent to the user.

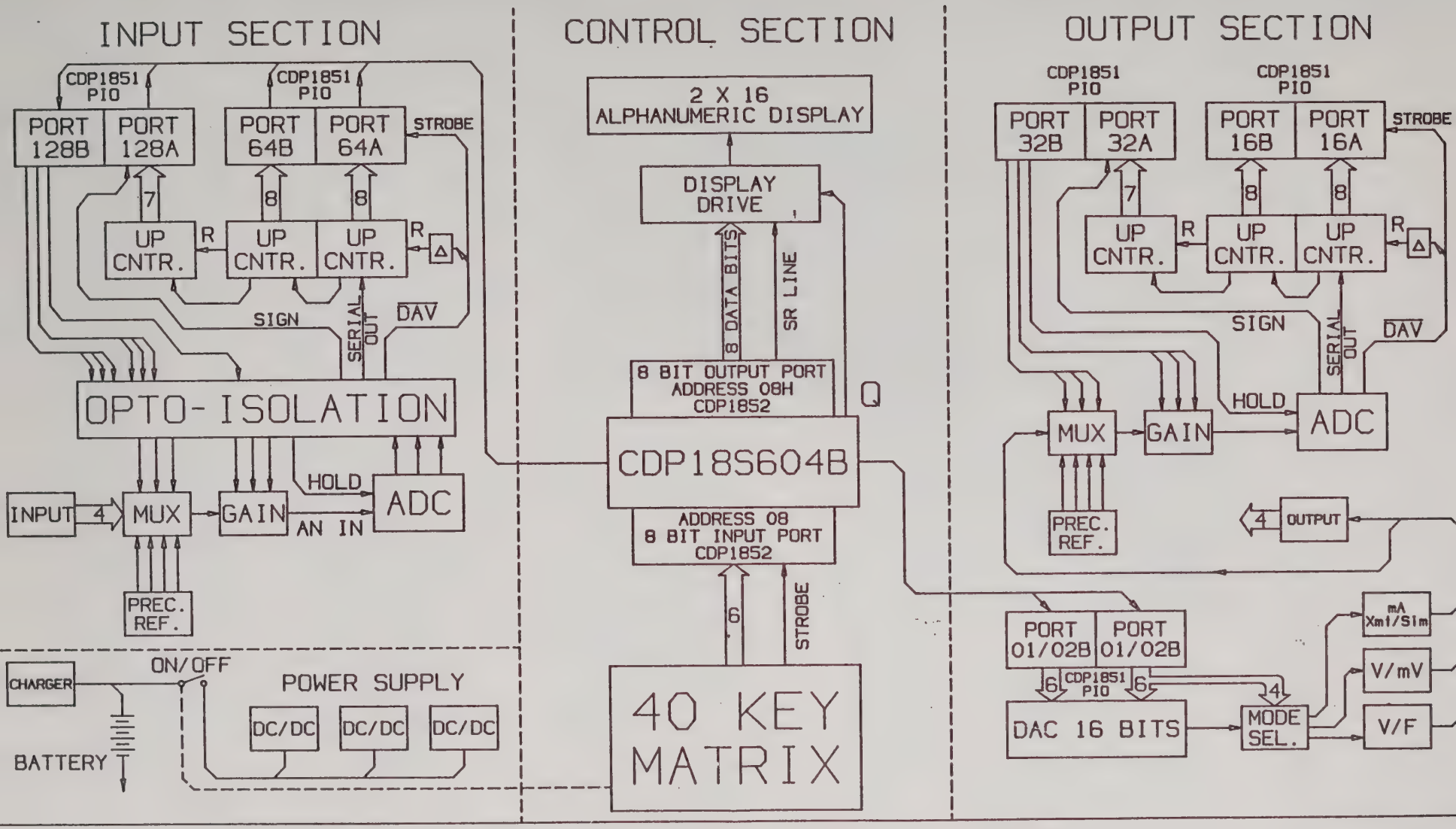


FIG. 1-1 CL6000 BLOCK DIAGRAM

2.3 Circuit Description

The following paragraphs will describe each of the major circuits.

2.4 Input Voltage Section (Refer to Figure 2-1)

Signals connected to the terminals labeled V, MV, F and TC are connected to U3 pin 5 via input protection circuit board. The input protection circuit is designed to provide voltage and current limiting if an over-voltage is applied to the input terminals. U3 is an 8 channel multiplexer controlled by the microprocessor. When volts, millivolts or thermocouple function is selected, U3 pin 5 is connected to the buffer amplifier U5A. The output of U5A is amplified by U5B with a nominal gain of 10. The output of U5A is also connected to a 10 to 1 divider R37 and R46. If the millivolt or thermocouple function is selected the input signal is connected to the A to D converter with a gain of 10. If the voltage function is selected, auto-ranging is controlled by the microprocessor via U11. Auto-ranging occurs at 20,400 counts for an increasing measurement, and at 1950 counts for a decreasing measurement.

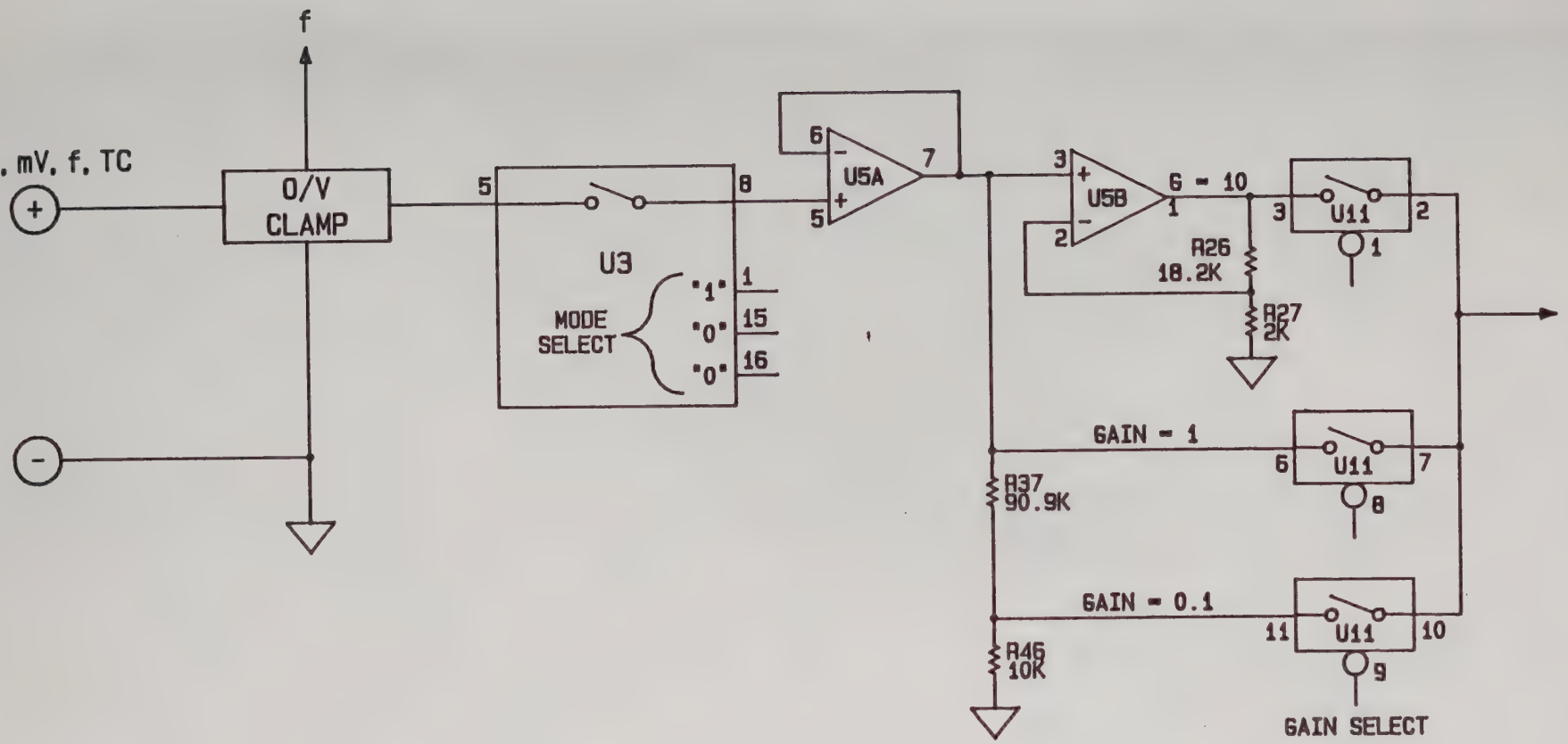
2.5 Current Input Section (Refer to Figure 3-1)

Figure 3-1 is a Current Input Functional diagram, signals are coupled through the input terminals and fuse F1 to the precision 10 ohm resistor, R22. The voltage developed across this resistor is connected through resistor R25 to input pin 6 of U3. The combination of R25 and TS2 form an input protection network to limit the voltage and current if an overload occurs on the input. Fuse F1 protects precision resistor R22 from overload. All milliamp signals are measured on the gain of 1 range, i.e., 0 to 2 volts full scale.

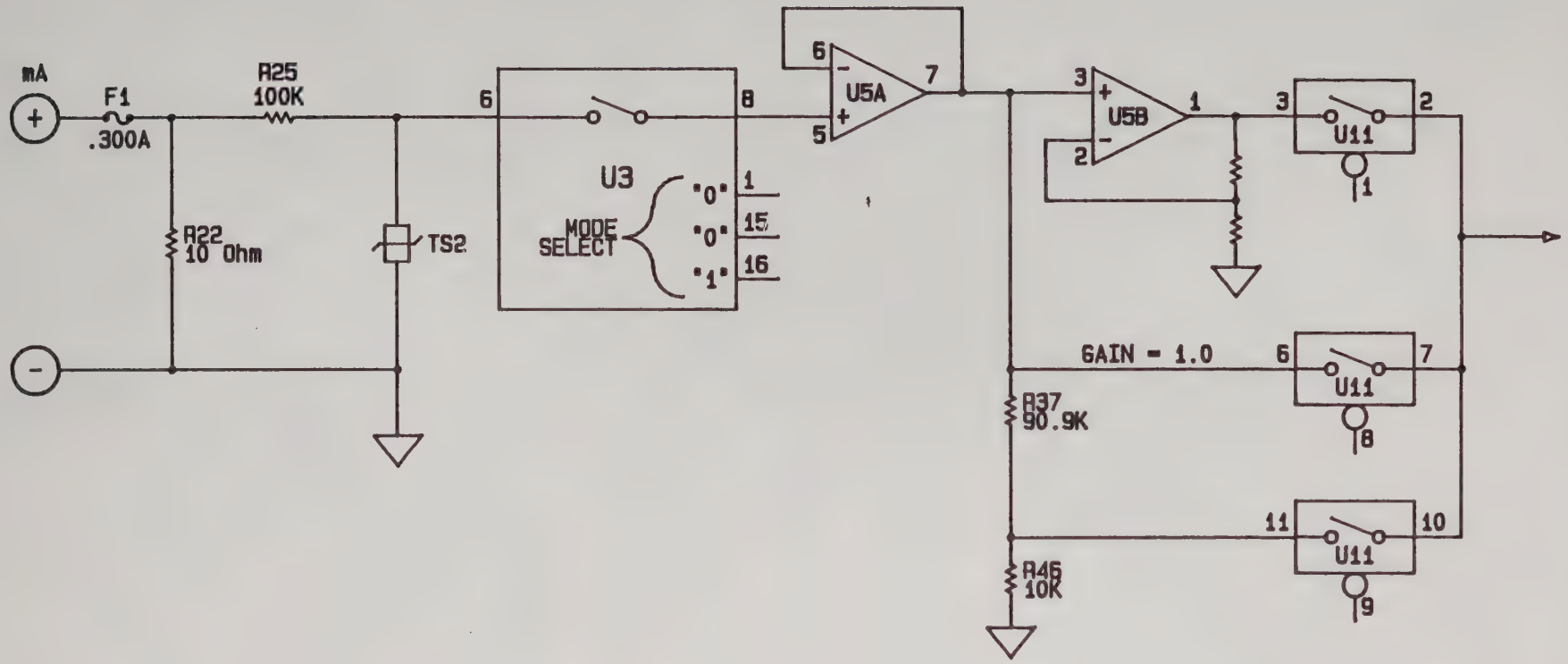
2.6 Ohms Input Section (Refer to Figure 4-1)

The ohms measurement circuit determines the value of an unknown resistance by comparison. When the same current is applied to a resistance of known value and a resistance of unknown value the voltage level developed across each is directly proportional to the value of each resistance. A comparison of the two voltage levels will indicate the value of the unknown resistance relative to the value of the known resistance.

The current to be applied to the known and unknown resistance is supplied by op amp U2B. One input to this op amp is connected to a precision 100 millivolt reference. The op amp output is connected to the positive ohms measurement terminal. When an unknown resistance is connected across the ohms measurement terminals, current flows through the unknown resistance and through precision resistor R34. The voltage developed across R34 is fed back

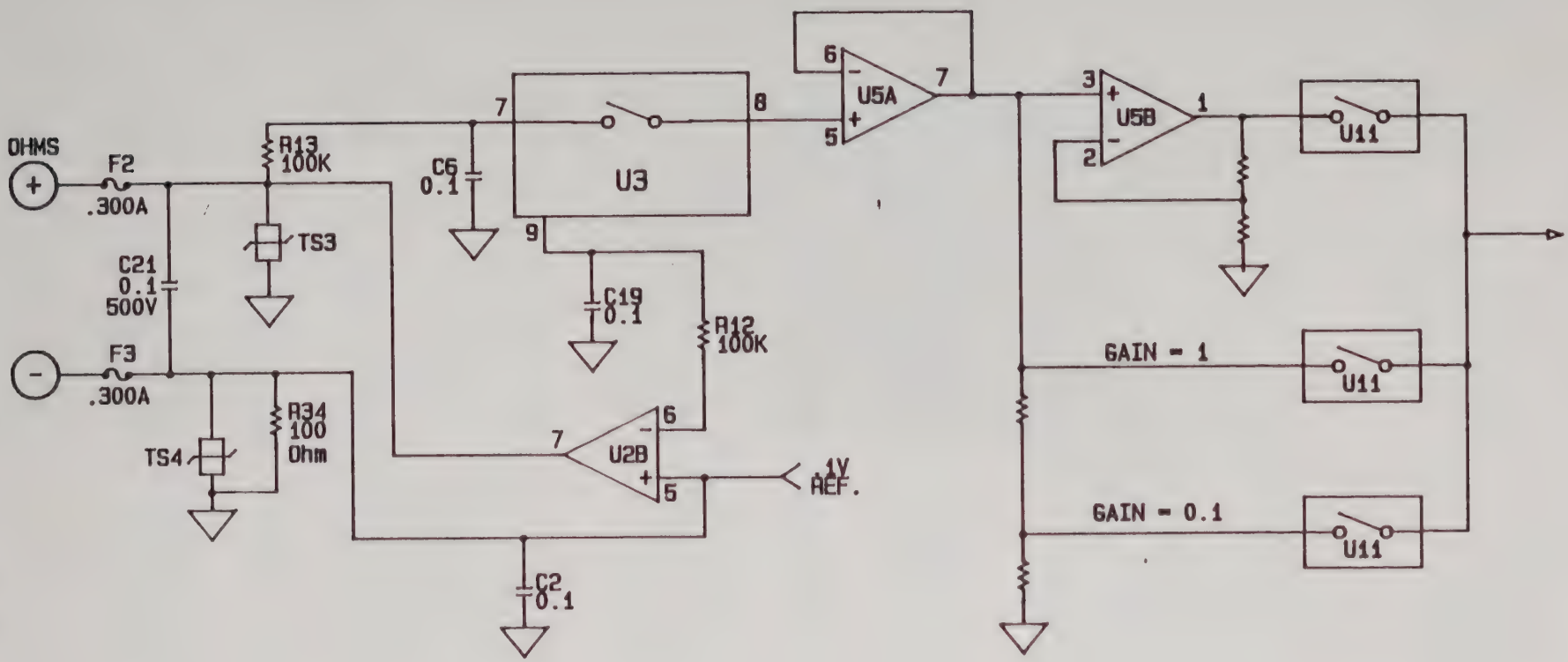


VOLTAGE INPUT FUNCTIONAL DIAGRAM
FIG.2-1



CURRENT INPUT FUNCTIONAL DIAGRAM

FIG.3-1



OHMS INPUT FUNCTIONAL DIAGRAM

FIG.4-1

to U2B to maintain a constant current of 1 milliamp. This voltage is also measured in order to compensate for any variation in current. The total voltage drop across the unknown resistance and R34 is measured and the unknown resistance calculated as:

$$Rx = \frac{Vx - Vr34}{I}$$

Circuit protection is provided by F2, F3, TS3, and TS4.

2.7 Frequency Input Section (Refer to Figure 5-1)

Frequency input signals are AC coupled to op amp U2A through capacitor C1. The over-voltage clamp circuit limits the input signal to a safe operating level. Op amp U2 provides a gain of approximately 130 and its output is connected Integrated Circuit U12. U12 is a NAND schmitt trigger. It improves the signal rise-time and provides a logic level output.

The output of U12 connects via ribbon cable to the counters located on the Analog Input Interface Board. Software timers sample these counters each second to determine the incoming frequency.

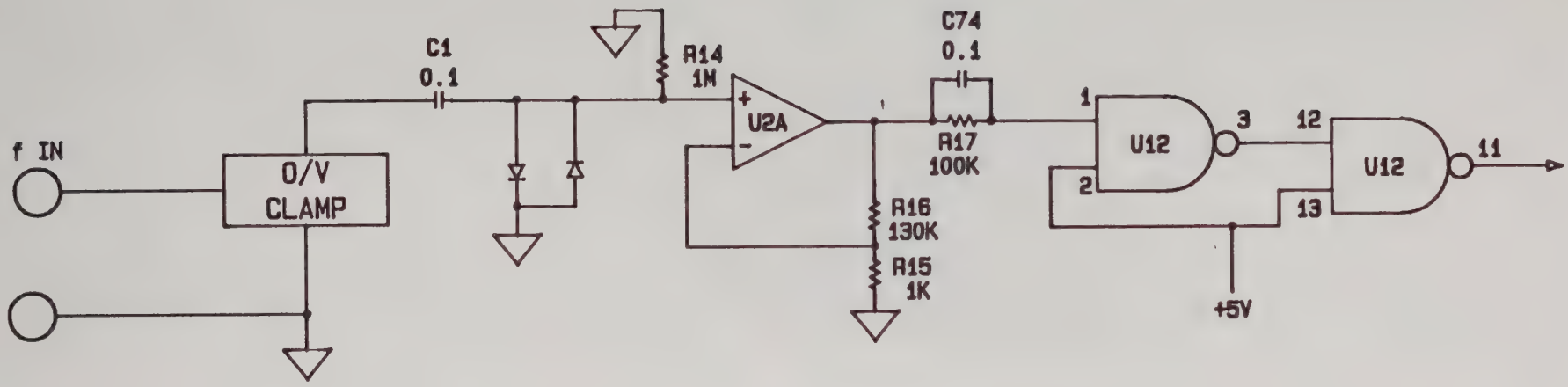
2.8 Analog to Digital Converter Section (Refer to Figure 6-1 and Drawing No. 1048-351, Sheets 2 and 3)

The Analog to Digital converter utilizes a quad slope conversion technique to minimize errors. In addition, the microprocessor periodically samples precision reference voltages of 100 millivolts, 1 volt, 10 volts and ground and does a software calibration to compensate for measurement errors.

The output of the Analog to Digital converter is a pulse count proportional to the measured voltage. The pulses are totalized by a series of counter stages U20, U21 and U22 on the analog interface card. At the end of a conversion cycle signal DAV is generated which strobes the count into programmable I/O ports U3A, U3B and U4A. After a short delay, the counters are reset and another measurement cycle begins. The converter makes approximately 3 conversions per second.

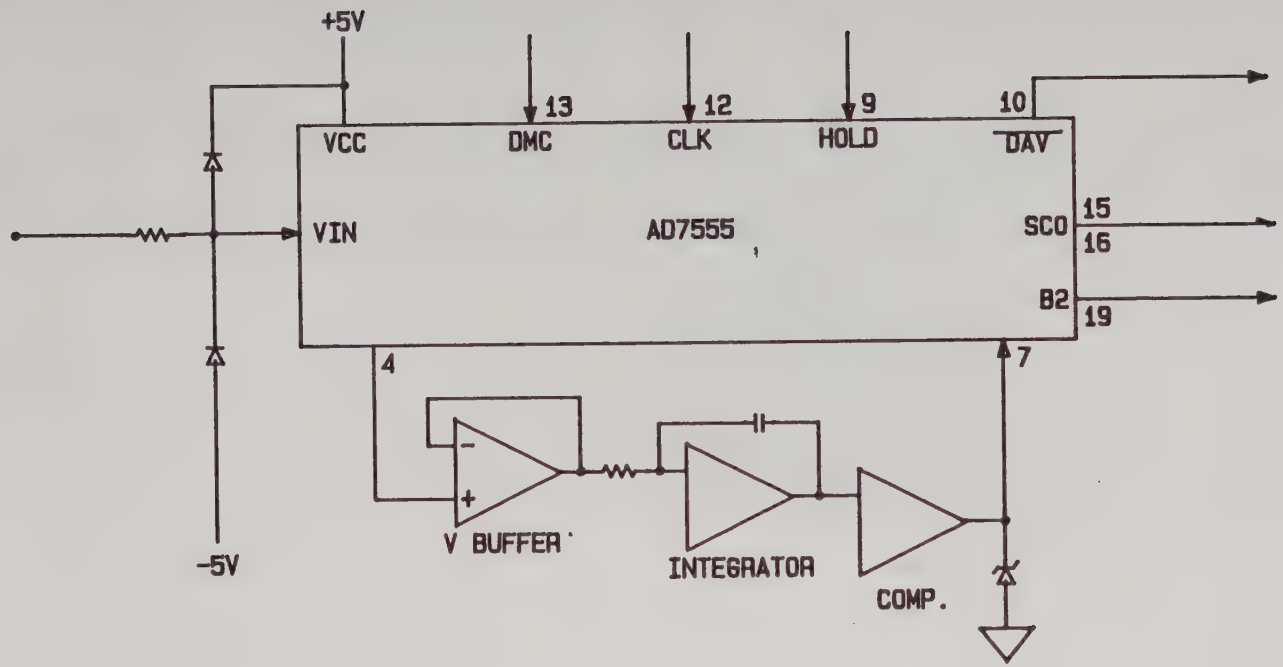
2.9 Digital to Analog Converter (Refer to Drawing 1048-310, Sheets 2 and 3)

A 16 bit Digital to Analog converter is used to produce the output signals based on operator requested inputs. The output signals are measured and adjusted to insure their accuracy and integrity.



FREQUENCY INPUT FUNCTIONAL DIAGRAM

FIG.5-1



ANALOG/DIGITAL CONVERTER FUNCTIONAL

FIG.6-1

When an output function is selected, a control code consisting of 4 bits is loaded into the lower half of I/O port U1. This control code is then latched into quad latch U9. This sets up the switches required to connect the DAC signals to the output terminals. The data for the DAC (16 bits) is loaded in 2 steps. First the lower 8 bits are loaded then the high 8 bits. When the high 8 bits are loaded a Ready signal is generated causing the 16 bits of data to be transferred and latched by the DAC. The DAC output is buffered by U18.

2.10 Voltage Output Section (Refer to Figure 7-1)

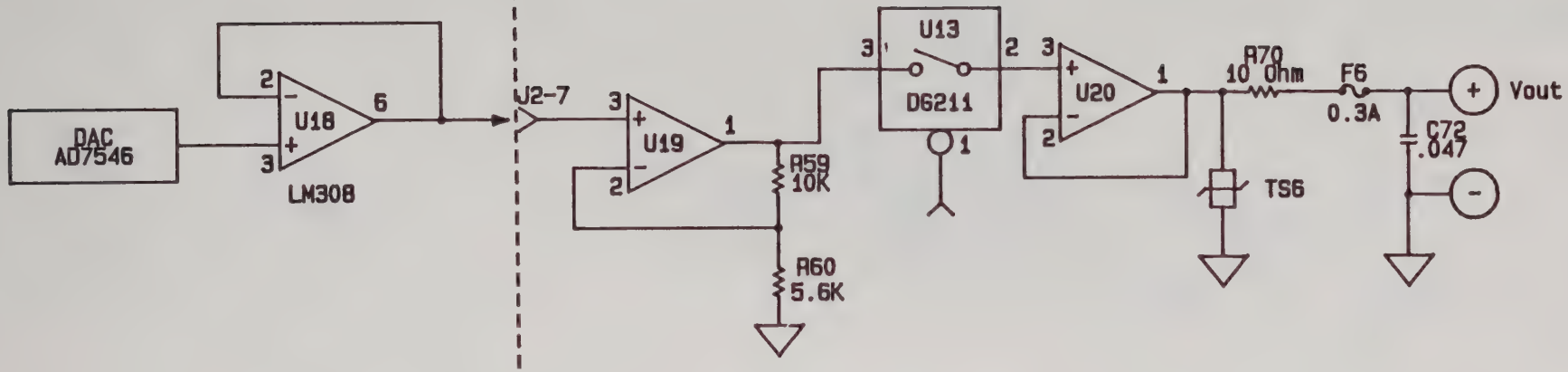
The DAC output is connected to the Analog I/O bd via ribbon connector. U19 provides a gain of approximately 2.8 to the output stage. Voltage signals are connected to output buffer amplifier via switch U13. Op amp U20 is the output driver. Circuit protection is provided by TS6, R20 and F6. Millivolt signals are divided approximately 50 to 1 by R47 and R48 and also buffered by U20.

2.11 Current Output Section (Refer to Figure 8-1)

Current outputs are controlled by U19 and Q2. CR 21 limits the gate drive to Q2 and CR20 protects against reverse polarity. F4 and F5 limit the maximum current in or out of the mA out terminals. Resistor R50 is a precision 10 ohm device which is used to provide feedback of the output current.

2.12 Frequency Output (Refer to Figure 9-1)

Frequency output is derived from a voltage to frequency converter, U29. Output amplitude is controlled by the voltage supplied to Q1. To provide the voltage required to set frequency, as well as to set the amplitude, U27 is used as a sample and hold circuit. When frequency output is selected, the calibrator requests the peak to peak amplitude. When the amplitude value is entered via the keyboard, the output of U19 is connected to C61 through U13, and also to the output terminals. The output is adjusted to the requested value. The voltage on C61 will equal this value and remain when U13 opens. The input impedance of U27 is sufficiently high to minimize the discharge of C61. Next, the output of U19 is connected to C60 through U25. The voltage is adjusted until the required frequency is measured at the output terminals. Periodically, the voltage on C61 is refreshed to minimize droop in the output amplitude.

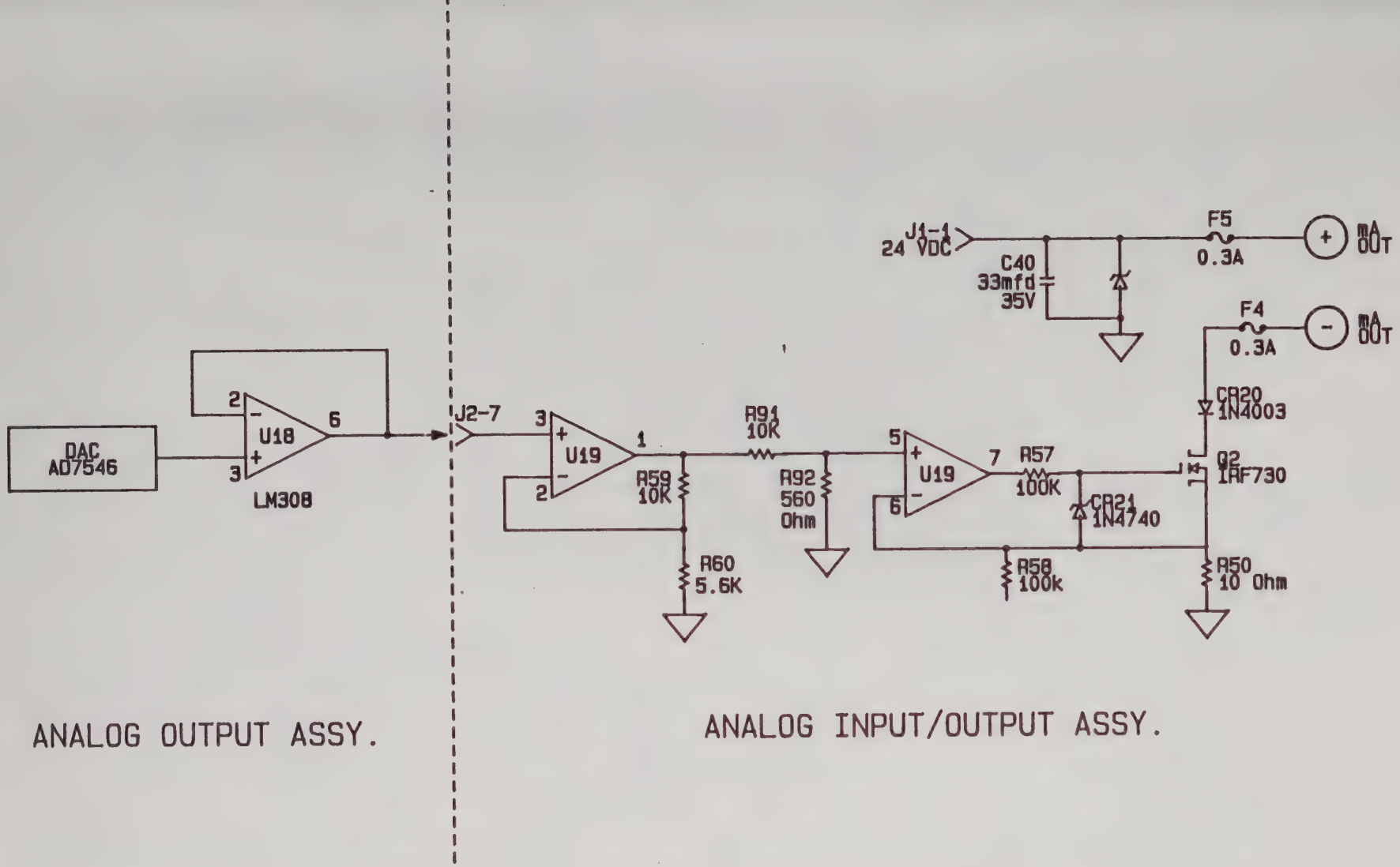


ANALOG OUTPUT ASSY.

ANALOG INPUT/OUTPUT ASSY.

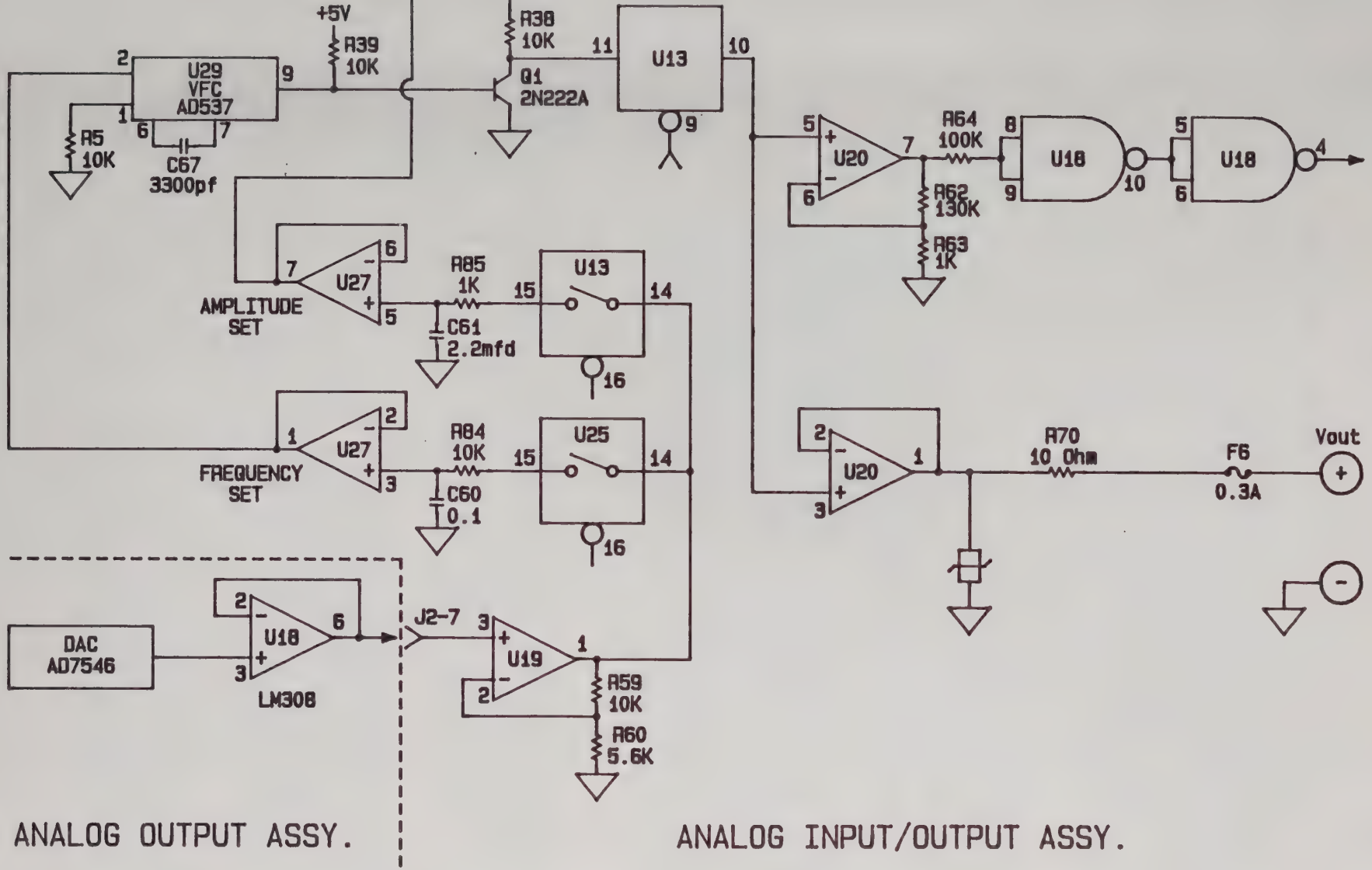
VOLTAGE OUTPUT FUNCTIONAL DIAGRAM

FIG.7-1



CURRENT OUTPUT FUNCTIONAL DIAGRAM

FIG.8-1



FREQUENCY OUTPUT FUNCTIONAL DIAGRAM

FIG.9-1

2.13 Power Supply Section (Refer to Drawing 1048-320)

DC power for the instrument is derived from the external battery charger/power supply or the internal battery pack. If the charger is connected and energized, operating voltage for the calibrator will be supplied from the charger/supply through relay K1. The battery pack will also be charged from a separate tap on the charger/supply. Power on/off is controlled by Z1, which operates as a flip-flop each time the on/off switch is pressed. Q1 is a power FET which is turned on and off by Z1. When the gate of Q1 is high Q1 is turned on, energizing the calibrator.

PS1, PS2, and PS3 are DC to DC converters which convert the 5 volts DC to ± 12 volts and + 24 volts DC. PS1 supplies the isolated power for the input measurement section, PS2 supplies non-isolated power, and PS3 supplies 24 volt power.

2.14 CPU Section (Refer to Drawings 1048-305 or 1055-536)

The CPU section incorporates a microprocessor, programmable timer, 1024 bytes of read/write memory, an 8 bit input port and an 8 bit output port, and sockets for EPROM memory. There are 2 versions, one supports up to 12K bytes of EPROM and is identified by the presence of an added printed circuit board to house the EPROM's. Drawing 1048-305 details this CPU board. The second supports up to 32K of EPROM which is incorporated directly on the main printed circuit board. Drawing 1055-536 details this CPU board.

Basic operation of the CPU section is as follows:

When power is first turned on an RC network generates a reset and clear signal to initialize the microprocessor and input/output ports. This causes the microprocessor to start executing code at location 0000. Location 0000 is the beginning location of EPROM memory and contains initialization and setup instructions.

Following the setup portion of the program a message is generated to the display requesting the operator enter a 1 to obtain battery save or a 0 to bypass it. The message to the display is generated by successive loading of the ASCII characters for each letter (or number) into the output port (U5 or Z25). When the output port is loaded by the microprocessor the port's SR line pulses, signaling the display to accept data.

When a key is pressed, data at the input port, U6 or Z26, is latched by a strobe pulse STB generated in the keyboard section. If a 1 or 0 is decoded the calibrator enters an Auto Calibration Cycle, otherwise it will wait for a 1 or 0.

Immediately preceding the Auto Cal cycle the programmable timer is setup to provide an interrupt every 7.813 mSec. This timer is used to update software tasks such as keyboard and display service and frequency measurement. The programmable timer is the only device which generates an interrupt. All other devices are polled on a schedule and their flag lines indicate activity.

2.15 Display Section

The liquid crystal display is a 2 line, 16 character per line module which accepts an ASCII encoded input. Data and control characters are loaded into the CPU output port which connects via ribbon cable to the display module. A line from the CPU designated as the "Q" line sets the display control to accept either character data or control data. The display must be initialized prior to receiving data. This initialization consists of setting the direction of character entry, clearing the display, setting the cursor on or off and homing the cursor to the first character position.

A "Busy Flag" is available from the display module, however, software controls the data transfer rate so that the flag is not needed. Control commands are executed in 1.6 to 2.0 mSec., while display characters can be written in 40 to 100 micro-seconds.

3.0 PERFORMANCE TEST

The performance test is designed to compare the CL-6000 performance with the accuracy specifications given in the operators manual. It is recommended as a periodic calibration test procedure. If the instrument is repaired, repeat the test to verify proper operation. If the instrument fails any part of the test, recalibration or repair is indicated.

3.1 Recommended Equipment

Nomenclature	Model No.	Usage
Resistance Decade Box	Gen. Rad. 1433-W	Ohms Input
Frequency Source	Wavetek 185	Frequency Input
Frequency Counter	Fluke 1953A	Frequency In/Out
Oscilloscope	Tektronix 2213	Frequency In/Out
6 1/2 Digit DVM	HP 3456A	V,mV,mA In/Out
DC mV/mA Source	EDC CR103	V,mV,mA In/Out
Ice Point Reference	OMEGA TRC III	TC In/Out

3.2 Initial Procedure

The following conditions should exist prior to testing.

1. The instrument should be stabilized at room ambient temperature preferably at 23 ± 5°C. The relative humidity should be less than 70 percent.

2. The instrument batteries should be fully charged. Allow fourteen (14) hours for charging.

3. A minimum of five (5) minutes should be allowed for warm-up after turn-on.

3.3 DC Volts Input Test

1. Select Volts Input and connect a short across the V input terminals.

2. The display should indicate "+/- 0.00000," +/- 0.00003 volts.

3. Connect the EDC-CR103 voltage source to the V input terminals and adjust it to 2.00000. Verify the setting with the HP3456A voltmeter.

4. The display should indicate + 2.00000, +/- 0.00005 volts.

5. Increase the voltage source setting to 10.0000 volts.

6. The display should indicate 10.000, +/- 0.003 volts.

3.4 Millivolts Input Test

1. Select the mV input function and short the V input terminals.

2. The display should indicate 0.00, +/- 0.03 mV.

3. Connect the EDC-CR103 voltage source to the V input terminals and adjust it to 200.000 mV.

4. The display should indicate + 200.00, +/- 0.05 mV.

3.5 Current Input Test

1. Select the mA input function and short the mA input terminals.

2. The display should indicate 0.00, +/- 0.01 mA.

3. Connect the EDC-CR103 to the mA input terminals and adjust it to output 20.000 mA.

4. The display should indicate + 20.00, +/- 0.01 mA.

5. Increase the mA source setting to 200.000 mA.

6. The display should indicate + 200.00, +/- 0.10 mA.

3.6 OHMS Input Test

1. Select the ohms input function and connect the ohms input terminals to the Gen Rad Model 1433W decade box.

2. Short the decade box terminals and note the reading on the calibrator. This value will be subtracted from the following readings to compensate for lead resistance.

3. Adjust the decade resistance box for 10.00 ohms.

4. Subtract the value obtained in Step 2 from the displayed value. The result should be 10.00, +/- 0.06 ohms.

5. Adjust the decade box to 100.00 ohms. Repeat Step 4 and the result should be 100.00, +/- 0.06 ohms.

6. Adjust the decade box to 999.99 ohms. Repeat Step 4 and the result should be 999.9, +/- 1.0 ohms.

3.7 Frequency Input Test

In the following tests use the Fluke Model 1953A to monitor and set the desired frequency from the Wavetek.

1. Select frequency input and connect the Wavetek Model 185 frequency generator to the input terminals. Set the generator to obtain a 10 Hz square wave of approximately 150 mVolts amplitude. The duty cycle should be approximately 50 percent.

2. The display should indicate 0.0100, +/- 0.0009 KHz after approximately 10 seconds.

3. Increase the frequency setting to 1.000 KHz. The display should indicate 1.000 KHz, +/- 0.001 KHz.

4. Increase the frequency setting to 20.000 KHz. The display should indicate 20.00 KHz, +/- 0.01 KHz.

5. Increase the frequency setting to 50.000 KHz. The display should indicate 50.00 KHz, +/- 0.01 KHz.

3.8 Thermocouple Input Test

If the instrument performed satisfactorily when the mV test was performed it is unlikely to malfunction on TC input unless the reference junction compensator is mis-adjusted or malfunctioning. To check the reference junction compensator:

1. Turn the instrument on and select Type J, Degrees C input. Submerge a "J" reference thermocouple in the TRC III Ice Point Reference. Firmly short the copper leads of the T/C by clamping the spade lugs with an alligator clip. Attach the white T/C lead to the V/f/TC input positive jack. Attach its red lead to the V/f/TC input negative jack. Allow 1 minute stablization time.

2. The instrument should indicate 0.0°C + or - 0.1°C. If it reads higher than 0.0°C but the reading is decreasing allow additional time for stablization.

3.9 Voltage Output Test

1. Select Volts output and connect the HP3456A voltmeter to the calibrator voltage output terminals.

2. Enter 1 volt and the display should indicate 1.0000 volts, + or - 0.0005 volts. The HP 3456A should indicate 1 volt, +/- 0.5 millivolts.

3. Enter 10 volts and the display should indicate 10.000 volts, +/- 0.005 volts. The HP 3456A should indicate 10 volts, +/- 0.5 millivolts.

3.10 Millivolts Output Test

1. Select mVolts output and connect the HP3456A voltmeter to the calibrator voltage output terminals.

2. Enter 0 millivolts and the display should indicate 0.00 mVolts, +/- 0.05 mV. The HP 3456A should indicate 0 millivolts, +/- 50 microvolts.

3. Enter 200 millivolts and the display should indicate 200.00 mVolts, +/- 0.05 mV. The HP 3456A should indicate 200 millivolts, +/- 50 microvolts.

3.11 Current Output Test

1. Select mA output and connect a 10 ohm ±0.01 percent resistor across the mA output terminals. Connect the HP 3456A voltmeter across this 10 ohm resistor.

2. Enter 20 mA and the display should indicate 20.00 mAmps, +/- 0.01 mA. The HP 3456A should indicate 200 millivolts, +/- 0.1 millivolts.

3. Enter 50 mA and the display should indicate 50.00 mAmps, +/- 0.03 mA. The HP 3456A should indicate 500 millivolts, +/- 0.3 millivolts.

3.12 Transmitter Simulator Test

1. Select Xmtr Sim and connect one end of the 10 ohm ±0.01 percent resistor to positive Xmtr Sim terminal.

2. Connect the other end of the 10 ohm resistor to the positive output of a DC power supply. The supply should have an output in the range of 12 to 60 volts DC.

3. Connect the negative side of the supply to the negative Xmtr Sim terminal on the calibrator.

4. Connect the HP 3456A across the 10 ohm resistor and enter 20 mA. The display should indicate 20.00 mAmps, +/- 0.01 mA. The HP 3456A should indicate 200 millivolts, +/- 0.1 millivolts.

5. Enter 50 mA and the display should indicate 50.00 mA, +/- 0.03 mA. The HP 3456A should indicate 500 millivolts, +/- 0.3 millivolts.

3.13 Frequency Output Test

1. Select frequency output and enter 5 volts for PP-Amplitude. Enter 1 KHz for frequency output.

2. Connect the Fluke 1953A frequency counter to the output terminals and verify the frequency at 1 KHz, +/- 0.1 Hz.

3. Connect the Tektronix Model 2213 oscilloscope across the output terminals and verify the amplitude at 5 volts peak to peak, +/- 0.1 volts.

4. Enter 19 KHz and verify the calibrator output with the Fluke 1953A at 19.000, +/- 1 Hz. Verify the amplitude at 5 volts peak to peak as in Step 3.

3.14 Thermocouple Output Test

1. Connect the TRC III Ice Point Reference as described in Paragraph 3.8.1. Select TC, Type J for both input and output. Request 0°C as an output.

2. Note the display readings after allowing at least 1 minute for settling. Both input and output should indicate 0.0°C, +/- 0.1°C.

4.0 MAINTENANCE

4.1 Introduction

This section of the manual contains information concerning maintenance and servicing of the Model CL-6000 calibrator.

4.2 Service Information

Each instrument manufactured by RIS is warranted for a period of one year from the date of shipment. Information regarding this warranty is contained on a warranty card included with each instrument.

4.3 General Maintenance

If the instrument requires cleaning and/or maintenance, use the following procedure to gain access.

4.4 Access/Disassembly

1. Remove the instrument from the nylon outer carrying case. It is held in place by an elastic strap secured top and bottom with Velcro.

2. Remove the top cover. Four screws hold it in place.

3. Disconnect the battery charger.

4. Remove the calibrator from the base by removing 2-1/4 inch oval head screws (Item 6 on 1048-301, Sheet 4).

5. Loosen the battery pack by removing 2 screws (Item 23) and partially withdraw the pack. Disconnect the battery pack connector from the power supply board.

6. Disconnect the ribbon cables at the top of the PC cards (see 1048-301, Sheet 1). Also remove the end of cable J6 from LCD display.

7. Remove four screws holding the faceplate assembly.

8. Individual PC boards may now be removed by pulling straight upward. Care should be taken when removing the analog I/O board - it is attached to the faceplate assembly.

9. The motherboard may be removed by sliding it out of its guides toward the front of the unit.

4.5 Preliminary Checks

Examine PC boards for damage. Pay particular attention to the interconnecting wires between the faceplate and the analog I/O board. Make sure the banana jacks on the front panel are securely fastened. Make sure all socketed integrated circuits are firmly installed in their sockets and that all leads are properly inserted.

If testing is required the instrument may be assembled outside the case as shown on 1048-301, Sheet 1. This will permit access to internal circuits. Care should be taken to avoid shorts between PC boards. The power supply and battery pack should be installed and connected.

4.6 Power Supply Check

Incorrect voltages from the power supply may cause the instrument to operate improperly. Always check battery voltage, charger voltage, and all DC to DC converter voltages in the event of an instrument malfunction.

4.7 Fault Area Isolation

TEST AND SYMPTOM	POSSIBLE CAUSE/REMEDY
Power On - Blank Display	Batteries fully discharged - repeat with charger connected. Press any key except on/off. If no "beep," check the Power Supply PCB per Paragraph 5.18. If "beep" is heard, check for loose cable connectors between analog out bd and display and between micro-bd and analog out bd. Proceed to display troubleshooting See Paragraph 5.20.
Display Shows Random Characters	Check connector from micro-bd to analog output bd. Proceed to display troubleshooting, see Paragraph 5.20.
Display Stays in "AUTOCAL"	Check Input Section A to D. See Paragraph 5.8 converter. Check Output Section A to D converter. See Paragraph 5.9.
Inoperative Voltage Input	Check other input functions. If other functions work, troubleshoot voltage input. See Paragraph 5.3. If other functions do not work, troubleshoot A to D converter. See Paragraph 5.8.
Inoperative Millivolt or Thermocouple Input	Check other input functions. If other functions work, troubleshoot millivolt input. See Paragraph 5.4. If other functions do not work, troubleshoot A to D converter. See Paragraph 5.8.
Inoperative Milliamp Input	Check other input functions. If other functions work, troubleshoot milliamp input. See Paragraph 5.5. If other functions do not work, troubleshoot A to D converter. See Paragraph 5.8.

TEST AND SYMPTOM	POSSIBLE CAUSE/REMEDY
Inoperative Frequency Input	Check other input functions. If other input functions work, troubleshoot frequency input. See Paragraph 5.7.
Inoperative Voltage Output	Check other output functions. If other functions work, troubleshoot Voltage Output Section. See Paragraph 5.11. If other functions do not work, troubleshoot D to A Section. See Paragraph 5.10.
Inoperative Millivolt and TC Output	Check other output functions. If other output functions work, troubleshoot the MV Output Section. See Paragraph 5.12. If other functions do not work, troubleshoot the D to A Section. See Paragraph 5.10.
Inoperative Milliamp Output	Check other output functions. If other output functions work, troubleshoot the MA Output Section. See Paragraph 5.13. If other functions do not work, troubleshoot the D to A Section. See Paragraph 5.10.
Inoperative Frequency Output	Check other output functions. If other output functions work, troubleshoot the Frequency Output Section. See Paragraph 5.14. If other functions do not work, troubleshoot the D to A Section. See Paragraph 5.10.

4.7 Fault Area Isolation (Continued)

TEST AND SYMPTOM	POSSIBLE CAUSE/REMEDY
Calibration Error on Input Measurement	Check precision reference voltages on Input Section. See Paragraph 5.17.
Calibration Error on Output Section	Check precision reference voltages on Output Section. See Paragraph 5.21.
Instrument Operation less than 4 Hours following 14 Hour Charge	Check charge current. See Paragraph 5.18.1. Check voltage across each battery. Should be 1.2 to 1.4 volts. If below 1.0 volts, replace bad battery.
No audible tone when key is is pressed-Response-Ok	Troubleshoot tone generator circuit. See Paragraph 5.16.1.
No audible tone-No Response	Troubleshoot keyboard scanner circuit. See Paragraph 5.16.2.
Incorrect response from keyboard	Troubleshoot keyboard scanner and buffer circuit. See Paragraph 5.16.3.
No response from on/off switch	Troubleshoot the membrane keyboard. See Paragraph 5.16.4. And On/Off circuit.

5.0 TROUBLESHOOTING

5.1 Introduction

CAUTION

STATIC DISCHARGE CAN DAMAGE CMOS COMPONENTS CONTAINED IN THE CL6000. TO PREVENT THIS POSSIBILITY, USE THE FOLLOWING PRECAUTIONS WHEN TROUBLESHOOTING AND/OR REPAIRING THE INSTRUMENTS.

1. Never remove, install, or otherwise connect or disconnect PCB's and/or components without first turning off power.

2. Perform all repairs at a static free work station.

3. Do not handle IC's or PCB's by their connectors.

4. Use static ground straps to discharge repair personnel.

5. Use conductive foam to store replacement or removed IC's.

6. Use a grounded soldering iron.

5.2 Preliminary Checks

1. Carefully inspect the instrument for signs of physical damage such as broken wires, loose connections and or components.

2. Check that the PC boards are securely plugged into their sockets.

3. Check interconnecting cables for proper seating and alignment.

4. Check that the instrument is malfunctioning before attempting repair.

5.3 Voltage Input Section

Refer to Schematic and Assembly 1048-351, Sheets 2 and 3 and Drawing 1056-214 for the following:

Apply 10 Volts DC to the V input terminals. Check for 10 volts on U3, Pin 5. If 10 volts is not found check for broken connections on the input terminals and the CL 6005 TRANSZORB DAUGHTER BD. Check R93 for open and TS1 for short circuit. If 10 volts is present on U3, Pin 5, select V input and check the address bits for U3 as follows: U3, Pin 1 = high, Pin 15 and 16, low. If the address is correct

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replace U3. If not, trace the address bits through the opto-isolators to the I/O port on the analog interface card (Drawing 1048-315, Sheets 1 and 2).

5.4 Millivolt or TC Input Section

The millivolt/TC inputs follow the same signal path as voltage inputs, however, a gain of 10 amplifier U5B is utilized. If voltage input works properly apply 100 mVolts to the input and check U5 and U11. U5, Pin 3 should be approximately 100 millivolts and Pin 1 should be approximately 1 volt. Note that every 20 readings an input reference voltage will be read and for one reading the output will change. When the millivolt function is selected U11, Pin 1 should go low. This connects U5, Pin 1 to the A to D converter. U11 is selected by the I/O port on the analog interface. Thermocouples are measured by the same components as millivolts. In addition the reference junction temperature is measured by the output A to D section.

5.5 Current Input Section

Refer to Schematic and Assembly 1048-315, Sheets 2 and 3. Apply 20 milliamps to the input terminals and select mA input. If unable to input current, check fuse F1, Resistor R22, and interconnections for open circuits.

Check the voltage at U3, Pin 6. It should be approximately 200 millivolts with 20mA input. If not present check R25 and TS2. If present check U3 address bits as follows: Pin 16 high, Pins 1 and 15 low. If address is okay check U3, Pin 8 for 200 millivolts. If not present replace U3. Check U11, Pin 6 for 200 millivolts. U11, Pin 8 should be low for the mA input function. Check U11, Pin 7 for 200 millivolts.

5.6 Ohms Input Section

Refer to Schematic and Assembly 1048-315, Sheets 2 and 3 and use the following procedure when troubleshooting malfunctions in the OHMS Section.

1. Connect a 1000 ohm resistor across the ohms input terminals.

2. Measure the voltage drop across this resistor. It should be 1 volt ±50 millivolts. If no voltage, check F2, F3 and U2.

3. If the voltage is low check TS3 for leakage. Check R34 for an increase in resistance.

4. If the voltage is high check F3, TS4, R34 and U2.

5. If all of the above check okay, measure the voltage at U3, Pin 7. It should be approximately 1 volt. Check U3, Pin 9. It should be approximately 0.1 volts.

6. Check the output of U3, Pin 8. This will require an oscilloscope. The output should alternate between 0.1 volts and 1.0 volts with every 20th reading being a reference voltage.

7. Check the address lines of U3, Pins 1, 15 and 16. When U3, Pin 7 is to be selected, U3 Pins 1 and 16 should be high and Pin 15 low. When U3, Pin 9 is to be selected, U3 Pins 1, 15 and 16 will be high.

8. If an addressing problem is located, check from the origin of the address, U4 of the analog input interface card. Refer to Schematic and Assembly 1048-315, Sheets 1 and 2.

5.7 Frequency Input Section

Refer to Drawing 1048-351, Sheets 2 and 3 and use the following procedure when troubleshooting malfunctions in the Frequency Input section.

1. Connect a 1 KHz, 5 Volt square wave to the frequency input terminals and select the frequency input function.

2. With an oscilloscope, trace the signal from the input terminals, through the over-voltage protection circuit and C1, to the input of op amp U2, Pin 3. The signal at this point will be attenuated to approximately 0.6 to 0.7 volts.

3. Check the output of U2 at Pin 1. It should be approximately 18 volts peak to peak.

4. Check the output of U12 at Pin 11. It should be a 5 volt square wave. This signal connects to the Analog Interface board via connector J3.

5. Check the signal at the gate of Q1. (See Drawing 1048-315, Sheets 1 and 2.)

6. Check the signal of U14 at Pin 6. NOTE: the scope ground will have to be moved to the negative output terminal for this check.

7. Check the output of U16 at Pin 10. If there is no signal here, check U16, Pin 12. It should be +5 volts when the frequency input function is selected. If it is low or zero, recheck that frequency input is selected. If so, IC U4 is probably defective.

5.8 Input A to D Section

When the instrument is first turned on an automatic calibration cycle is initiated by software. The display will indicate "Auto Cal" and 6 readings of Input Section reference voltages will be attempted. If these readings are unsuccessful the instrument will remain in the Auto Cal mode. If 6 readings are obtained, the software will advance to attempt 8 readings with the output A to D. Refer to Schematic and Assembly Drawings 1048-351, Sheets 2 and 3.

To determine whether the input A to D is functioning, connect an oscilloscope to U9, Pin 10 and connect scope ground to isolated ground (available at the V minus input terminal).

1. When power is turned on, 6 positive pulses should be observed approximately 300 milliseconds apart. Recycle power off and on to verify this operation. The pulse width will be approximately 20 milliseconds and amplitude 5 volts. If operation is satisfactory proceed to Output A to D Section. If not proceed to Step 2.

2. Verify all supply voltages on U6, 7, 8, and 9. Check the DMC clock on U9, Pin 13. It should be a 5 volt square wave 60 to 120 Hz. Check the master clock on U9, Pin 13. When the A to D is active, it will be approximately 3 to 4 volts amplitude at a frequency of 1 MHz. The amplitude will vary as the converter operates.

3. Verify the Hold input on U9, Pin 9. In normal operation, hold goes to +5V to start a conversion. If it stays low the converter will be disabled. If all voltages check and the DMC and master clock are present and Hold is at +5V, replace the following components one by one until the problem is eliminated: U6, U7, U8 and U9.

5.9 Output A to D Section

Refer to Schematic and Assembly Drawing 1048-351, Sheets 1 and 3.

When power is turned on, the Input A to D converter is calibrated. Approximately 3 seconds later the output A to D will be checked, if the input section operates.

Connect an oscilloscope to U22, Pin 9. Scope ground should be connected to the V minus output terminal.

1. Approximately 3 seconds after power is turned on, 8 positive pulses should be observed 300 milliseconds apart. Recycle power off and on to verify this operation. The pulse width will be approximately 20

milliseconds and amplitude 5 volts. If operation is satisfactory proceed to the Counter and Programmable I/O Port Section. If not proceed to Step 2.

2. Verify all supply voltages on U15, 16, 17 and 22. Check the DMC clock on U22, Pin 13. It should be a 5 volt square wave 60 to 120 Hz. Check the master clock on U22, Pin 13. The amplitude will be 3 to 5 volts at a frequency of 1 MHz. The amplitude will vary as the converter operates.

3. Verify the Hold input on U22 Pin 9. In normal operation Hold goes to +5V to start a conversion. If it stays low the converter will be disabled. If all voltages check and the DMC and master clock are present and Hold is at +5V, replace the following components one by one until the problem is eliminated: U15, U16, U17 and U22.

5.10 Digital To Analog Section

Refer to Schematic and Assembly Drawings 1048-310, Sheets 2 and 3 and use the following procedure when troubleshooting malfunctions in the D to A section.

1. Select volts out and enter 10 volts. The D to A output should be 3 to 4 volts. If it is 4.5 to 4.7 volts as measured at U2, Pin 22, check the voltage at TP10. If voltage is 4.5 to 4.7 the problem is probably in the output section or output A to D.

2. If the voltage is low or 0 at the D to A output, check U2, Pin 19. A negative pulse should appear here, approximately every second. If it does the D to A converter, U2, is probably defective. If not, check U1, Pin 16 for a positive pulse. If no pulse, check U1 select input on Pin 2. If the select line is being pulsed U1 is probably defective.

3. If U1 is not being selected, check U3, U4, U6 and U8. Check the incoming address and timing signals at the motherboard connector.

5.11 Voltage Output Section

Refer to Schematic and Assembly 1048-351, Sheets 1 and 3 and use the following procedure when troubleshooting malfunctions in the voltage output section.

1. Select volts out and enter 10 volts. Verify an output from the D to A of 3 to 5 volts at U19, Pin 3. If the input does not appear, go to the D to A Troubleshooting Section.

2. Check the output of U19, Pin 1, it should be 10 volts.

3. Check U13, Pin 2. It should be 10 volts. If not check U13, Pin 1. If it is low check U13.

4. Check U20, Pin 1. It should be at the same voltage as Pin 3.

5. Check R70 and F6 for open circuit. Check TS6 and C72 for short circuit.

6. If the output is over-range check the transzorb board see Drawing 1056-214. Check U24, Pin 5. It should be the same as the output voltage. If it is, check U24. If not, check R80 and C56.

5.12 Millivolt Output Section

Refer to Schematic and Assembly 1048-351, Sheets 1 and 3 and use the following procedure when troubleshooting malfunctions in the millivolt output section.

1. Select millivolts output and enter 200 mV. Verify an output from the D to A on U19, Pin 3 of 3 to 5 volts. The output of U19, Pin 1 should be 8.5 to 9.5 volts.

2. Check U13, Pin 6. It should be 200 mV. If not, check R47 and R48. If it is, check U13, Pin 7; it should be 200 mV. If not, check that U13, Pin 8 is low.

3. Check U20, Pin 1. It should be at the same voltage as Pin 3.

4. Check R70 and F6 for open circuit. Check TS6 and C72 for short circuit.

5. If the output is over-range check the transzorb board and check the voltage at U24, Pin 5. It should be the same as the output. If it is, check U24.

5.13 Current and Transmitter Simulator Section

Refer to Schematic and Assembly 1048-351, Sheets 1 and 3 and use the following procedure when troubleshooting malfunctions in the Milliamp and Transmitter Simulator Section.

1. Select mA output and connect a milliamp meter across the mA out terminals. The output should be less than 1 mA.

2. Enter 20 mA and observe the output. If it is 0, check F4 and F5.

3. Check the voltage across CR19. It should be approximately 24 VDC. This voltage is derived from PS3 on the power supply board.

4. Check the voltage at U19, Pin 3. It should be 1.0 to 1.5 volts. U19, Pin 1 should be 3.5 to 4.0 volts. U19, Pin 7 should be 3.5 to 4.0 volts.

   If these voltages are high and the output current is high, check the voltage across R50. It should be 200 mV when 20 mA is flowing in the output in the output. Check the voltage at U24, Pin 6. It should be equal to the voltage across R50. If it is, check U24.

5. If the voltages are high through U19 Pin 7, but output current is low, check CR20, CR21, Q2 and R50.

5.14 Frequency Output Section

Refer to Schematic and Assembly 1048-351, Sheets 1 and 3 and use the following procedure when troubleshooting malfunctions in the Frequency Output Section.

1. Select frequency out and enter 5 volts amplitude. Enter 1 KHz frequency and check the output with an oscilloscope. Determine the type of malfunction and proceed to the appropriate section.

   If no output, go to No. 2
   If incorrect frequency go, to No. 3
   If incorrect amplitude go, to No. 4

2. Check F6, R70 and TS6. Connect the scope to U20, Pin 3. It should indicate a 5 volt square wave. Check U27, Pin 7; it should be 4.75 to 5.25 volts DC. If this voltage is 0 or negative, check U27, C61, R85 and U13. Check the base of Q1. It should have a 0.6 to 0.7 volt 1 KHz square wave. Check Q1 and R39. Check the voltage at U27, Pin 1. It should be approximately 0.3 volts. Check C60, R84 and U25.

3. If the output frequency is out of calibration, measure it with the input section. If they agree but are known to be incorrect the master time base on the microprocessor is off frequency. Check the frequency at TP4 of the microprocessor card. It should be 2.097152 MHz ±0.015%. If the frequency is off, check C12, C13, V1 and Z12 on the microprocessor board. If the frequency is correct, troubleshoot Z16, Z23, Z21 and Z22 on the microprocessor card.

4. If the amplitude is low, check C61, R85 and U27. Also check U13 and Q1.

5.15 Thermocouple Temperature Reference

Refer to Schematic and Assembly 1048-351, Sheets 1 and 3 and use the following procedure when troubleshooting the thermocouple temperature reference.

1. Measure the voltage at U10, Pin 5. It should be 0.6 volts ±50 mV when the calibrator is at room temperature. If incorrect, check for 10 volts on the supply side of R43. Check R43 and Q3.

2. Check U10, Pin 7, it should be the same as U10, Pin 5. Check U24, Pin 7; it should be approximately 580 mV. Check R35, R42 and R36.

5.16 Keyboard Section

Refer to Schematic and Assembly Drawing 1048-310, Sheet 1 and 3 for the following:

5.16.1 Tone Generator

Measure the voltage at U14, Pin 6. It is normally low and will go high when a key is pressed. The output of U14, Pin 4 will go low enabling oscillator U19. The output of U19, Pin 3 should be a 5 volt square wave approximately 1 KHz. U15 inverts the output of U19 and drives transistor Q1. Diode CR7 is a noise suppressor across the tone generator. The tone generator is located on the motherboard.

5.16.2 Keyboard Scanner

Check the output of U14, Pin 10. It should be a 5 volt square wave when U14, Pin 1 is low. This 5 volt square wave is on U13 Pin 1. The outputs of U13, Pins 4, 5, 6, 11, 12 and 13, drive U11 and U12. Check each output of U13 for a 5 volts square wave. The U13 outputs drive address lines of U12. The U12 outputs on Pins 1, 12, 13, 14 and 15 sequentially drive the membrane keyboard columns. These outputs appear as a 5 volt sawtooth. U11 sequentially scans the membrane keyboard rows. When a key is pressed the U12 output will be connected to one of U11's 8 inputs. When that input is sampled U11, Pin 3 will go to +5 volts and cause the oscillator U14 to stop. At this time the inputs to U11 and U12 indicate the matrix address of the key which was pressed.

5.16.3 Keyboard Buffer

The keyboard matrix address is buffered by U16 and is read by the microprocessor input port when the signal STB-P is generated at U15, Pin 6. The STB-P output is a positive 5 volt pulse of approximately 150 microseconds duration.

5.16.4 Membrane Keyboard

The keyboard can be checked in-circuit by the above tests. However, the on/off switch is not part of the matrix. If there is no response from the on/off switch, disconnect the keyboard cable and check the resistance across the keyboard terminals 1 and 2 while pressing the on/off switch. It should be ≤ 100 ohms when pressed.

5.17 Precision Input Reference

If a calibration error is found, check the precision reference voltage section. Refer to Schematic and Assembly Drawing 1048-351, Sheets 2 and 3 for the following:

1. Check U1 output across R8. It should be 0.100000 volts +/- 25 microvolts. Adjust R1 to obtain 0.100000 volts ± 25 microvolts. If unable to adjust, check U1 input. It should be 12 VDC. Check R1, R2, R4, R90 and VR5.

2. Check the 1 volt reference at the junction of R6 and R7. It should be 1 volt ±20 microvolts. Check R6 and R7.

3. Check the 0.1 volt reference at the junction of R7 and R8. It should be 0.1 volts ±20 microvolts. Check R7 and R8.

4. If the above checks out, but a calibration error remains, the A to D converter is the likely cause. Refer to the A to D converter section.

5.18 Power Supply Troubleshooting

Remove the power supply PCB and place it on a nonconductive work surface. Connect the battery pack to J3 connector. Refer to S & A Drawing C-1048-320, Sheets 1 and 2 for component locations. Connect the negative side of a DC voltmeter to TP1 for the following tests.

1. Measure the voltage at Z1 Pin 14. It should be at least 4.75 volts. If not ≥ 4.75 volts, check battery pack and connector J3. If problem is in the battery pack, disassemble and check battery connections. Check individual cell voltages. A cell with 0 volts output is probably defective. If cell voltages are less than 1.1 volts, attempt to recharge the pack.

2. Measure the voltage at TP9. It will be 0 when the power supply is "off." Momentarily short pins A and B on the PCB card edge connector and observe the voltage at TP9 should go to approximately 5 volts. If it does not, check IC Z1, R1, R2 and C2. Replace the defective component and recheck.

3. If the voltage at TP9 goes to 4.75 volts, check the voltage at TP10, it should be less than 0.2 volts. Check PS1, 2 and 3 individually by measuring across their outputs. Note that PS1 output is isolated from TP1 so the negative side of the voltmeter will have to be moved to TP6 to test it. PS2 and PS3 may be tested with the voltmeter negative on TP1. PS2 outputs should be $\geq$ -12V at TP5, $\geq$ +12V at TP4. PS3 output should be $\geq$ +24 volts at TP3. PS1 outputs should be measured from TP6. TP8 $\geq$ -12Volts, TP7 $\geq$ +12 volts. If any voltage is not present or is incorrect, replace the defective DC - DC converter.

5.18.1 Battery Charger

1. Connect the charger output to the power-supply and connect the charger to 115 VAC, ±10%, 60 Hz line. Install cable J2.

2. Verify relay K1 energizes when AC power is applied to the charger by measuring the voltage from TP1 to TP2. This voltage will increase when the charger is energized.

3. Make sure the power supply is off (TP1 to TP9 low) and measure the voltage across R4. It should be approximately 2 volts, indicating a 400 mA charge to the batteries.

4. Repair by replacement is recommended if the charger is defective.

5.19 CPU Section

Refer to Schematic and Assembly Drawing 1055-535, Sheets 1 through 4 for the following. Troubleshooting of the CPU Section, or microprocessor board, should be limited to some degree due to circuit board density and complexity. Repair by circuit board replacement should be considered if the following technique does not identify the defective component.

1. Examine the board carefully under a magnifying glass for mechanical problems such as shorts, circuit board cuts and cracked components.

2. Check the EPROMS's for proper insertion in their sockets.

3. With the circuit board installed as shown in Drawing 1048-301, Sheet 1, turn the calibrator on and check the signal at TP4. It should be a 2 MHz square wave 5 volts amplitude. This is the master oscillator.

4. Check the program timer output at U14, Pin 8. It should be an 8 ms 5 volt square wave.

5. Check the 5 volt supply on U12, Pins 16 and 40.

6. If no problem is found, circuit board replacement is recommended.

5.20 Display Section

The CL-6000 has utilized two different displays.

One is identified by a metal cage mounting style while the other uses a double PC board. In either case repair by replacement is recommended. Refer to Schematic and Assembly Drawings 1048-310, Sheets 1 and 3 for the following:

1. Check for +5V at the display.

2. Turn the viewing angle adjustment R13 and monitor the voltage change. Approximately +0.75 volts will produce viewable dots.

3. Monitor the Enable or Start operation line with an oscilloscope. Cycle power off and on and verify pulses on this line. If no pulses are present, check U17 and U15 for pulses in and out. If pulses are not present on U15, Pin 11, check the microprocessor board output port.

4. Monitor the A0 or RS line with the oscilloscope. Cycle power off and on and verify pulses on this line. If no pulses are present check U17, Pin 1 and the microprocessor Q line output. If no pulses are on the Q line, proceed to the microprocessor section. If pulses are present replace the display module.

5.21 Precision Output Reference

If a calibration error is found, check the precision reference voltage section. Refer to Schemetic and Assembly Drawing 1048-351, Sheets 1 and 3 for the following:

1. Check U23 output at R76. It should be 10 volts ± 30 microvolts. Adjust R69 if necessary. If unable to adjust, check the 12 VDC input to U23. Check R73, R71, R69, R89 and VR4.

2. Check the 1 volt reference at the junction of R75 and R76. It should be 1 volt, ± 25 microvolts. check R75 and R76.

3. Check the 0.1 volt reference at the junction of R74 and R75. It should be 0.1 volts ± 25 microvolts. Check R74 and R75.

4. If the above checks out, but a calibration error remains, the A to D converter is the likely cause. Refer to the A to D converter section.

6.0 REPLACEMENT PARTS

6.1 Introduction

This section contains a parts breakdown for the instrument. Components are listed by assembly. Electrical components are listed by reference designation and mechanical components are listed by item number. The parts lists include the following information:

a. Reference designation or item number.

b. Description of each part.

c. RIS stock number.

d. Total quantity per assembly.

e. Recommended quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of 2 years. It is presumed that common electronic parts such as resistors, capacitors and commonly used integrated circuits, diodes and transistors are available at the maintenance site. At remote locations it is recommended that a set of major assemblies be stocked.

NOTE:

Integrated circuits in the parts lists and on the schematics are designated as either U __ or Z __.

CL6000 PROBE ASS'Y KIT

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
	ALLIGATOR CLIP SET	0620-430	1.0 EA	2	2
	TEST LEAD SET CS-1000	0620-431	1.0 EA	1	2

CL6000 SWITCH MEMBRANE

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
ASSEMBLE P/N 1048-358, M/S TO PANEL AND TEST SPEC NO. 0000-000.	PANEL, FRONT	1048-389	1.0 EA	A	

CL6000 FACEPLATE ASS'Y

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
ITEM 11	SPONGE, CLOSED CELL 1/2 WD	0620-295	.01 FT	A	
ITEM 6 - TB1-6	MINI BANANA JACK-RED	0620-428	6.0 EA	A	2
ITEM 7 - TB7-12	MINI BANANA JACK-BLACK	0620-429	6.0 EA	A	2
ITEM 10	2-56 STL HEX NUT CAD	0627-005	3.0 EA	A	
ITEM 9	NO. 2 INT. TOOTH WSR CAD	0627-007	3.0 EA	A	
ITEM 8	WASHER NO. 4	0627-182	3.0 EA	B	
ITEM 5	CL6000 METALWORK T/C MTG	1048-395	1.0 EA	A	
ITEM 3	BRKT DISPLAY MTG.	1052-035	1.0 EA	A	
	CL6000 SWITCH MEMBRANE	1056-901	1.0 EA	C	
ITEM 4	LCD DISPLAY SEG DIG V	4860-026	1.0 EA	A	

CL6000 ASSEMBLY MECH.

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
ITEM 12	SPONGE, CLOSED CELL 1/2 WD	0620-295	0.2 FT	A	
ITEM 26	NO. 2 INT. TOOTH WSR CAD	0627-007	14.0 EA	A	
ITEM 21	4-40X1/4 PP MS CAD	0627-010	2.0 EA	A	
ITEM 22	4-40 KEPS NUTS CAD	0627-024	2.0 EA	A	
ITEM 7	SHOULDER WASHER 2664	0627-504	4.9 EA	A	
ITEM 20	SCREW, 2-56 X 1/4	0627-813	14.0 EA	A	
ITEM 6	SCREW 1/4-20X3/4 OVAL	0627-821	2.0 EA	A	
ITEM 5	WASHER FINISHING 1/4"	0627-822	2.0 EA	A	
ITEM 23	6-32X3/8 PHILLIP TRUSS	0627-832	2.0 EA	B	
REF. 1052-193, XP2	WIRE 20AWG ST BLK	0629-040	2.0 FT	B1	
ITEM	CL6012 BATTERY PACK	1048-384	1.0 EA	A	
ITEM 1 - ASS'Y PER D1048-301	BASE GUIDE	1048-385	1.0 EA	A	
ITEM 2	COVER, TOP	1048-386	1.0 EA	A	
ITEM 13	CARD CASE	1048-387	1.0 EA	A	
ITEM 16	PANEL, REAR	1048-388	1.0 EA	A	
ITEM 10	INSULATOR	1048-390	1.0 EA	A	
ITEM 9	CARD RETAINER	1048-393	1.0 EA	A	
ITEM 19 SCREEN B1051-392	S/N TAG CALIBRATOR	1051-391	1.0 EA	A	
ITEM 4	RETAINER CLIP	1052-095	2.0 EA	A	
ITEM 18	BRKT. PWR. CORD	1052-096	1.0 EA	A	
ITEM 8	CL6000 FACEPLATE ASS'Y	1052-210	1.0 EA	A	
ITEM 3	PLUNGER, SPRING-LOADED	3005-013	1.0 EA	A	
REF. 1052-193, XP2	CON HDW SOCKET TRI -	4003-502	1.0 EA	B1	
REF. 1052-193, P8	CON HDW 5M MINIHEX	4005-508	1.0 EA	B1	
REF. 1052-193, XP2	CON HDW REEL PIN SOCKET	4195-032	3.0 EA	B1	
ITEM 15	CARD GUIDE	4198-007	10.0 EA	A	
ITEM 14	CARD GUIDE NYLON ELEC SP FAB	4198-025	2.0 EA	A	
ITEM 11	BUMPER RBR-GROMMET RUBBER	6002-170	4.0 EA	A	

CL6000 HOUSING ASS'Y

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
	CL6003 ANA OUT PCB	1048-311	1.0 EA	A	
	CL6004 ANA INT PCB	1048-316	1.0 EA	A	
	CL6005 ANA I/O PCB	1048-352	1.0 EA	A	
	CL6006 MOTHERBOARD	1048-361	1.0 EA	A	
P5	CALIBRATOR FLAT CBL AS'Y	1048-367	1.0 EA	A	
J1	CALIBRATOR FLAT CBL AS'Y	1048-369	1.0 EA	A	
J2	CALIBRATOR FLAT CBL AS'Y	1048-371	1.0 EA	A	
J3, 4	CALIBRATOR FLAT CBL AS'Y	1048-373	2.0 EA	A	
J6	FLAT CABLE ASS'Y J6 FAB	1048-381	1.0 EA	A	
	CL-6001 PWR SUPPLY PCB	1048-382	1.0 EA	A	
ASS'Y PER D1048-301	ASSEMBLY, MECH. CL6000	1048-392	1.0 EA	A	
	CL6008 CALIB CPU	1055-535	1.0 EA	B	

CL6000 CALIBRATOR

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
MODEL CL6014	FUSE KIT GMW-3/10 10=BOX	0620-453	1.0 BX	A	2
	HOUSING ASS'Y CL6000	1048-365	1.0 EA	A	
	SHORT MANUAL SUPERCAL	1048-374	1.0 EA	A1	
MODEL CL6013	CL-6000 PROBE ASS'Y KIT	1048-378	2.0 EA	B	2
	CL-6011 CARRYING CASE	1048-383	1.0 EA	A	
	CL-6000 WARRANTY CARD	1052-290	1.0 EA	A	
	SUPPLY/CHARGER SPECS CL 6120	1056-853	1.0 EA	C	

CL6001 PWR SUPPLY PCB

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
TP-1-TP10, R3, R4	1558-2 CAMBION TERMINAL	0627-101	14.0 EA	H	
Z1	IC MM74C14 SCH TRIG HEX TTL	3132-687	1.0 EA	A	
PS1, 2, 3	IC PM671 CONV DC/DC 12V	3136-325	3.0 EA	A	1
C1, C6	CAP 1000U 16V ELEC R	3506-216	2.0 EA	A	1
C3-C5	CAP 10U 50V ELEC R	3512-503	3.0 EA	C	
C2, 8	CAP 1U 35V TANT R	3538-178	2.0 EA	G	
J3	CON PCB 2 HEADER	4002-001	1.0 EA	A	
J2	CON PCB 3 HEADER	4003-002	1.0 EA	A	
J1	CON HDW HEADER ASSY	4010-504	1.0 EA	A	
K1, K2	RELAY P T 5V C 5A SUBMIN PC	4500-007	2.0 EA	A	1
R5	RES 8.20K 1/4 5% CF	4707-144	1.0 EA	G	
R1	RES 47.00K 1/4 5% CF	4707-167	1.0 EA	G	
R2	RES 100.00K 1/4 5% CF	4707-180	1.0 EA	G	
R3	RES 0.20 2.0 3% WW	4720-020	1.0 EA	A	
R4	RES 5.10 2.0 5% CC	4721-004	1.0 EA	A	
CR1, CR2	DIODE 1N914 SIG A	4800-283	2.0 EA	A	
Q1	FETIRFZ30 50V A	4870-958	1.0 EA	D	

CL6003 ANA OUT PCB

ITEM #	DESCRIPTION			RIS STOCK #	QUAN PER	RV LV	REC QTY
JMP1	JUMPER, PVC 22, .600			0627-316	1.0 EA	A	
U5, 14, 19	IC, CD4001B	NOR QUAD 2I	CMOS	3132-252	3.0 EA	A	
U6	IC, CD4013BCN	FF D DUAL	CMOS	3132-288	1.0 EA	A	
U4	IC, CD4023B	NAND TRIP 3I	CMOS	3132-298	1.0 EA	A	
U11, 12	IC, CD4051BE	MUX/DMUX 8CHAN A		3132-301	2.0 EA	A	
U3	IC, CD4025BF3	NOR TRIP 3I	CMOS	3132-309	1.0 EA	A	
U15	IC, CD4049B	INV HEX BUF	CMOS	3132-318	1.0 EA	A	
U7	IC, CD4093B	SCH TRIG NAND	CMOS	3132-393	1.0 EA	A	
U17	IC, CD4011BE	NAND QUAD	CMOS	3132-652	1.0 EA	A	
U9	IC, CD4042BE	LCH D QUAD CLK	CMOS	3132-654	1.0 EA	A	
U16	IC, CD4050BE	HEXBUF NOSHRT	CMOS	3132-655	1.0 EA	A	
U13	IC, CD4520B	CTR BIN DUAL	CMOS	3132-680	1.0 EA	A	
U8	IC, MC14071B	OR QUAD 2I		3132-710	1.0 EA	A	
U1	IC, CDP1851CE	PRT I/O PRG	CMOS	3132-727	1.0 EA	A	
U18	IC, LM301AN	OP AMP		3135-161	1.0 EA	F3	1
U10	IC, LM324	QUAD OP AMP		3135-241	1.0 EA	A	
U2	IC, AD7546JN	MULT 16B DAC	CMOS	3135-279	1.0 EA	A	1
VR1	IC, LM79L05ACZ	3 TERM		3136-329	1.0 EA	A	1
FOR Z1, 2	SCKT IC, 40DIP PC			3140-013	2.0 EA	A	
J6	SCKT IC, 16DIP PC			3140-044	1.0 EA	A	
C1, 10, 17, 18	CAP	22U 15V TANT		3534-265	4.0 EA	A	
C16	CAP	22U 16V TANT R		3534-501	1.0 EA	A	
3538-294	CAP	4.7U 35V TANT R		3538-294	2.0 EA	F	
C21	CAP	20P 500V MICA R		3553-260	1.0 EA	A	
C23	CAP	200P 500V MICA R		3553-360	1.0 EA	C	
C4	CAP	.0022U 50V CER R		3555-003	1.0 EA	F	
C12	CAP	100P 100V NP0 R		3558-301	1.0 EA	A	
C7, 20	CAP	680P 100V NP0 R		3558-302	2.0 EA	A	
C5, 13, 14	CAP	1000P 50V NP0 R		3558-303	3.0 EA	A	
C11	CAP	3300P 50V NP0 R		3558-304	1.0 EA	A	
C3, 8	CAP	.0100U 50V CER R		3592-050	2.0 EA	A	
C9, 19	CAP	.0470U 50V CER R		3592-051	2.0 EA	E	
C22	CAP	.1000U 50V CER R		3592-052	1.0 EA	D	
J5	CON HDW 16	HEADER ASSY		4016-510	1.0 EA	A	
J2	CON HDW 20	HEADER ASSY		4020-011	1.0 EA	A	
TP1-10	CON HDW	PIN HALF		4195-096	10.0 EA	A	
R23, 24	RES 18.00 1/4 5%		CF	4707-042	2.0 EA	A	
R12	RES 2.00K 1/2 5%		CC.600	4712-123	1.0 EA	F2	
R29	RES 4.70 1/4 5%		CF	4723-021	1.0 EA	F2	
R22	RES 1.00K 1/4 5%		CF	4723-114	1.0 EA	F2	
R5-7, 19, 20	RES 10.00K 1/4 5%		CF	4723-148	5.0 EA	F2	
R2-4, 14, 16, 28	RES 22.00K 1/4 5%		CF	4723-157	6.0 EA	F2	
R15	RES 100.00K 1/4 5%		CF	4723-180	1.0 EA	F2	
R26, 27	RES 130.00K 1/4 5%		CF	4723-183	2.0 EA	F2	
R25	RES 270.00K 1/4 5%		CF	4723-193	1.0 EA	F2	
R18	RES 510.00K 1/4 5%		CF	4723-203	1.0 EA	F2	
R17	RES 4.7 OM 1/4 5%		CF	4723-236	1.0 EA	F2	
RN1	RES NET 10.0K 9RES 10P SIP			4781-053	1.0 EA	A	
CR3-7, 9	DIODE 1N914 SIG A			4800-283	6.0 EA	F2	
CR8	DIODE 1N4148 SIG .2A 75			4800-285	1.0 EA	F2	
VR2	ZENER 1N751A 5.1V .4W			4840-228	1.0 EA	A	
Q1	PNP2N3906 40V .2A 100TO-92 A			4870-635	1.0 EA	F4	
Q2	NPN2N5089 25V .05A 450TO-92 A			4870-825	1.0 EA	A	
R13	POT 20K 15T 0.750L PCB FRNT R13			5450-284	1.0 EA	A	1

CL6004 ANA INT PCB

ITEM #	DESCRIPTION		RIS STOCK #	QUAN PER	RV LV	REC QTY
FOR Q1, 2	TRANS-MOUNTING PAD TO-5		0620-426	2.0 EA	A	
U8	IC CD4001B NOR QUAD 2I	CMOS	3132-252	1.0 EA	A	
U7, 9	IC CD4013BCN FF D DUAL	CMOS	3132-288	2.0 EA	A	
U6	IC CD4023B NAND TRIP 3I	CMOS	3132-298	1.0 EA	A	
U5	IC CD4025BF3 NOR TRIP 3I	CMOS	3132-309	1.0 EA	A	
U10, 13	IC CD4093B SCH TRIG NAND	CMOS	3132-393	2.0 EA	A	
U12, 16	IC CD4016BE SW BILAT QUAD	CMOS	3132-653	2.0 EA	A	
U17-22	IC CD4520B CTR BIN DUAL	CMOS	3132-680	6.0 EA	A	
U11	IC MC14071B OR QUAD 2I		3132-710	1.0 EA	A	
Z1-4	IC CDP1851CE PRT I/O PRG	CMOS	3132-727	4.0 EA	A	1
U14, 15	IC 6N137 OPTOCPLR	TTL	3134-145	2.0 EA	A	1
U23-31	IC 4N46 OPTOCPLR H GAIN		3134-146	9.0 EA	A	1
C9	CAP 22U 15V TANT		3534-265	1.0 EA	A	
C1-8	CAP 1000P 50V NP0 R		3558-303	8.0 EA	A	
C10-11	CAP .0100U 50V CER R		3592-050	2.0 EA	A	
J3, 4	CON HDW 20 HEADER ASSY		4020-011	2.0 EA	A	
R7-8	RES 390.00 1/4 5% CF		4707-096	2.0 EA	A	
R4-6	RES 510.00 1/4 5% CF		4707-102	3.0 EA	A	
R3, 9-10	RES 4.70K 1/4 5% CF		4707-134	3.0 EA	A	
R11-12	RES 22.00K 1/4 5% CF		4707-157	2.0 EA	A	
R1-2, 13-16	RES 100.00K 1/4 5% CF		4707-180	6.0 EA	A	
RN3	RES NET 4.7K 7RES 8P SIP		4781-050	1.0 EA	A	
RN1, 2	RES NET 22.0K 5RES 6P SIP		4781-084	1.0 EA	A	
Q3	PNP2N3906 40V .2A 100TO-92 A		4870-635	1.0 EA	A2	
Q1, 2	FETVN35ABA 35V 2A TO-39 X		4870-929	2.0 EA	A	

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
F1-6	FUSE 3/10 AMP MICRO GMW	0620-085	6.0 EA	A	*
REF. Q1	SPACER/PAD	0620-347	1.0 EA	A	
REF. Z1, 23, Q4	TRANS-MOUNTING PAD TO-5	0620-426	3.0 EA	A	
	LUG, TAPED	0627-206	12.0 EA	A	
REF. Q2	SCREW 4-40X3/8	0627-399	3.0 EA	A	
REF. Q2	PAD, SILICONE	0627-438	1.0 EA	A	
REF. Q2	NUT, NYLON 4-40	0627-514	3.0 EA	A	
	WIRE 22 AWG ST BLK	0629-113	2.0 FT	A	
	WIRE 22 AWG ST RED	0629-115	2.0 FT	A	
TS2-4, 6	GZ34805A TRANSZORB	1051-271	4.0 EA	K	*
TS7, 8	SUP TRANS TRANZORB	1052-639	2.0 EA	B	*
	CL6005 TRANZORB DTR. PR	1056-213	1.0 EA	K	
U26	IC CD4013BCN FF D DUAL CMOS	3132-288	1.0 EA	A	
U4, 12, 14, 18	IC CD40938 SCH TRIG NAND CMOS	3132-393	4.0 EA	A	
U3,24	IC DG-508 MUX A 8CHAN CMOS	3132-712	2.0 EA	A	
U11, 13, 25	IC DG211CJ SW A QUAD SPDT TTL	3132-728	3.0 EA	A	
U9, 22	IC AD7555KN DIG ADC SUBS A	3132-729	2.0 EA	A	1
U28	IC 6N137 OPTOCPLR TTL	3134-145	1.0 EA	A	
U6, 8, 15, 17	IC LM301AN	3135-161	4.0 EA	A	
U7, 16	IC LF351N AMP OP	3135-257	2.0 EA	A	
U29	IC AD537JH CONV A V/F	3135-285	1.0 EA	A	
U2, 5, 10, 19-21, 27	IC AD644JN AMP OP DUAL FET	3135-296	7.0 EA	A	1
VR3	IC UA78L05AC REGUL 5V TO-92	3136-301	1.0 EA	A	
Z1, 23	IC AD581L REGUL H PREC 10V	3136-328	2.0 EA	A	
VR1, 2	IC LM79L05ACZ 3TERM -	3136-329	2.0 EA	A	
REF. Z9, 22	SCKT IC 28DIP PC	3140-048	2.0 EA	K1	
C48	CAP 1000U 16V ELEC R	3506-216	1.0 EA	A	1
C11, 25, 29, 39, 70	CAP 22U 16V TANT R	3534-501	5.0 EA	C	1
C40	CAP 33U 35V TANT	3538-291	1.0 EA	C	1
C12, 14	CAP 4.7U 35V TANT R	3538-294	2.0 EA	J	
C22, 24, 34, 71	CAP 390P 100V MICA R	3553-214	4.0 EA	A	
C42	CAP 39P 500V MICA R	3553-532	1.0 EA	A	
C61	CAP 2.2U 50V LOW LKG	3553-616	1.0 EA	G	
C67	CAP 3300P 50V NP0 R	3558-304	1.0 EA	A	
C15	CAP .3300U 630V FILM A	3569-112	1.0 EA	A	
C10, 23, 31, 35 66	CAP .0100U 50V CER R	3592-050	5.0 EA	A	
C1-9, 13, 16-21, 26-28, 30, 32, 37-38, 41, 43-47, 49-60 62-65, 68, 69, 74-76	CAP .1000U 50V CER R	3592-052	51.0 EA	I	
C72	CAP .0470U 100V CER R	3593-074	1.0 EA	G	
C33, 36	CAP .2200U 50V POLY A	3598-114	2.0 EA	A	
J1	CON HDW HEADER ASSY	4010-504	1.0 EA	A	
J2-4	CON HDW 20 HEADER ASSY	4020-011	3.0 EA	A	
REF. F1-6	CON HDW SOCKET CONTACT	4195-021	12.0 EA	A	
R4, 73	RES 22.10 1/8 1% 50P MF	4703-053	2.0 EA	A	
R24, 49	RES 200.00 1/8 1% 50P MF	4703-160	2.0 EA	A	
R29-30, 54-55	RES 10.00K 1/8 1% 50P MF	4703-377	4.0 EA	A	
R31, 56	RES 20.00K 1/8 1% 50P MF	4703-417	2.0 EA	A	
R43	RES 97.6K 1/8 1% 50P MF	4703-491	1.0 EA	L	
R27, 66	RES 2.00K 1/4 1% 25P MF	4706-296	2.0 EA	A	
R34, 44	RES 4.75K 1/4 1% 25P MF	4706-336	2.0 EA	A	
R32, 45	RES 4.99K 1/4 1% 25P MF	4706-338	2.0 EA	A	
R46, 83	RES 10.00K 1/4 1% 25P MF	4706-377	2.0 EA	A	
R26, 65	RES 18.20K 1/4 1% 25P MF	4706-411	2.0 EA	A	
R37, 82	RES 90.90K 1/4 1% 25P MF	4706-488	2.0 EA	A	
R70	RES 10.00 1/4 5% CF	4707-036	1.0 EA	A	
R48	RES 220.00 1/4 5% CF	4707-089	1.0 EA	A	
R86	RES 390.00 1/4 5% CF	4707-096	1.0 EA	A	
R92	RES 560.00 1/4 5% CF	4707-103	1.0 EA	A	
R15, 63, 85, 89, 90	RES 1.00K 1/4 5% CF	4707-114	5.0 EA	A	

CL6005 ANA I/O PCB
(continued)

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
R87	RES 2.70K 1/4 5% CF	4707-126	1.0 EA	A	
R2, 71	RES 4.30K 1/4 5% CF	4707-133	2.0 EA	A	
R60	RES 5.60K 1/4 5% CF	4707-137	1.0 EA	A	
R36, 38, 39, 47, 51, 59, 84, 91	RES 10.00K 1/4 5% CF	4707-148	8.0 EA	A	
R9-13, 17, 18 35, 57, 58, 64, 77-81	RES 100.00K 1/4 5% CF	4707-180	16.0 EA	L	
R16, 62	RES 130.00K 1/4 5% CF	4707-183	2.0 EA	E	
R19, 21, 40-41	RES 270.00K 1/4 5% CF	4707-193	4.0 EA	A	
R20, 28, 52, 53	RES 360.00K 1/4 5% CF	4707-197	4.0 EA	E	
R14, 61, 88	RES 1.00M 1/4 5% CF	4707-215	3.0 EA	A	
R25	RES 100.00K 1/2 CC .600	4712-180	1.0 EA	K	
R22, 50	RES 10.00 1/8.01 5P WW	4751-010	2.0 EA	A	
R34	RES 100.00 1/8.01 5P WW	4751-125	1.0 EA	A	
R8, 74	RES 1.00K 1/8.01 5P WW	4751-254	2.0 EA	A	
R7, 75	RES 9.00K 1/8.01 5P WW	4751-370	2.0 EA	A	
R6, 76	RES 90.00K 1/8.01 5P WW	4751-487	2.0 EA	A	
RP1	RES NET 22.0K 7RES 8P SIP	4781-085	1.0 EA	A1	
CR20	DIODE 1N4003 RECT 1A200	4800-111	1.0 EA	A	
CR1, 2	DIODE 1N4148 SIG. 2A 75	4800-285	2.0 EA	D	
CR8, 9, 14, 15	DIODE FD333 SIG A	4800-936	4.0 EA	D	
CR19	ZENER 1N4752A 33.0V 1W	4840-271	1.0 EA	A	
CR7, 18	ZENER 1N4732A 4.7V 1W	4840-605	2.0 EA	D	
CR21	ZENER 1N4740 10.0V 1W	4840-620	1.0 EA	A	
VR4, 5	ZENER LM329BZ 6.9V.02W	4840-808	2.0 EA	A	
Q1	NPNJAN2N222230V .8A 30TO-18 A	4870-276	1.0 EA	A	
Q2	FETIRF730 400V3.5A Y220 Z	4870-895	1.0 EA	F	1
Q4	FETVN35ABA 35V 2A TO-39 X	4870-929	1.0 EA	H	
Q3	MTS102, SENSOR	5120-001	1.0 EA	A	1
R42	POT 1K 15T 0.750L PCB FRNT	5450-150	1.0 EA	A	1
R1, 69	POT 10K 15T 0.750SQ PCB FRNT	5450-260	2.0 EA	A1	

CL6005 TRANZORB DTR. PR

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
TS1, 5	GZ34805A TRANZORB	1051-271	2.0 EA	A	1
PCB SET (2 PCS)	PCB CL6005 TRANZORB	1056-216	1.0 EA	A	
R3, 23, 67,	RES 100.00K 1/4 5% CF	4707-180	5.0 EA	B	
CR22-25	DIODE FD333 SIG A	4800-936	4.0 EA	A	1

CL6006 MOTHERBOARD

ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
P1-4	CON HDW 22 EDGE DUAL SPAC	4022-003	4.0 EA	A	1
REF. P1	CON HDW CARD KEY PLUG	4197-009	2.0 EA	A	
TG1	XDCR MIN AUD	5500-007	1.0 EA	A	

CL6008 CALIB CPU

ITEM #	DESCRIPTION		RIS STOCK #	QUAN PER	RV LV	REC QTY
TP1-4	1558-2 CAMBION TERMINAL		0627-101	4.0 EA	A	
J2, 4, 5	JUMPER PVC 22 0.200		0627-310	3.0 EA	B	
XY1	MICA WASHER		0627-364	1.0 EA	A	
Y1	CRYSTAL 2.097152MHZ		1055-828	1.0 EA	A	1
Z6, 7	IC CDP1825 RAM 1024X4	CMOS	3131-044	2.0 EA	A	
Z15	IC CD4013BCN FF D DUAL	CMOS	3132-288	1.0 EA	A	
Z14	IC CD4049AE INV HEX BUF/CTR		3132-320	1.0 EA	A	
Z1	IC CD4093B SCH TRIG NAND	CMOS	3132-393	1.0 EA	A	
Z13, 20	IC CD4050BE HEXBUF NOSHRT	CMOS	3132-655	2.0 EA	A	
Z23	IC MC14536B OSCILL/DIV PROG		3132-685	1.0 EA	A	
Z17	IC MC14071B OR QUAD 21		3132-710	1.0 EA	A	
Z16	IC MC14018B DIV BY N PRES	CMOS	3132-725	1.0 EA	A	
Z12	IC CDP1802AC PROG 8B PRL CPU		3132-750	1.0 EA	A	1
Z25, 26	IC CDP1852CE PORT I/O 8B	CMOS	3132-751	2.0 EA	A	1
Z24	IC CDP1853CE DCDR N BIT	CMOS	3132-752	1.0 EA	A	
Z4, 5	IC CDP1856CE BUS SEP/BUF	CMOS	3132-753	2.0 EA	A	
Z3	IC CDP1866CE MEM LCH/DCDR	CMOS	3132-755	1.0 EA	A	
Z2, 21, 22	IC CDP1867CE MEM LCH/DCDR	CMOS	3132-756	3.0 EA	A	1
Z18, 19	IC CD40107BE NAND DUAL DR	CMOS	3132-759	2.0 EA	A	
Z10, 11	IC 27C64 EPROM 8KX8	CMOS	3132-945	2.0 EA	A	
XZ12	SCKT IC 40DIP PC		3140-013	1.0 EA	A	
XZ8-11	SCKT IC 28DIP PC		3140-018	4.0 EA	A	
C11, 14	CAP 10U 20V TANT R		3535-231	2.0 EA	A	1
C1	CAP 2.2U 35V TANT R		3538-304	1.0 EA	A	
C2-10, 15-21	CAP .1000U 50V CER R		3592-052	16.0 EA	A	
R1, 4, 5	RES 22.00K 1/4 5% CF		4707-157	3.0 EA	A	
R2	RES 100.00K 1/4 5% CF		4707-180	1.0 EA	A	
R3	RES 22.00M 1/4 5% CF		4707-261	1.0 EA	A	
RP1-RP4	RES NET 22.0K 9 RES 1 OP SIP		4781-105	4.0 EA	A	

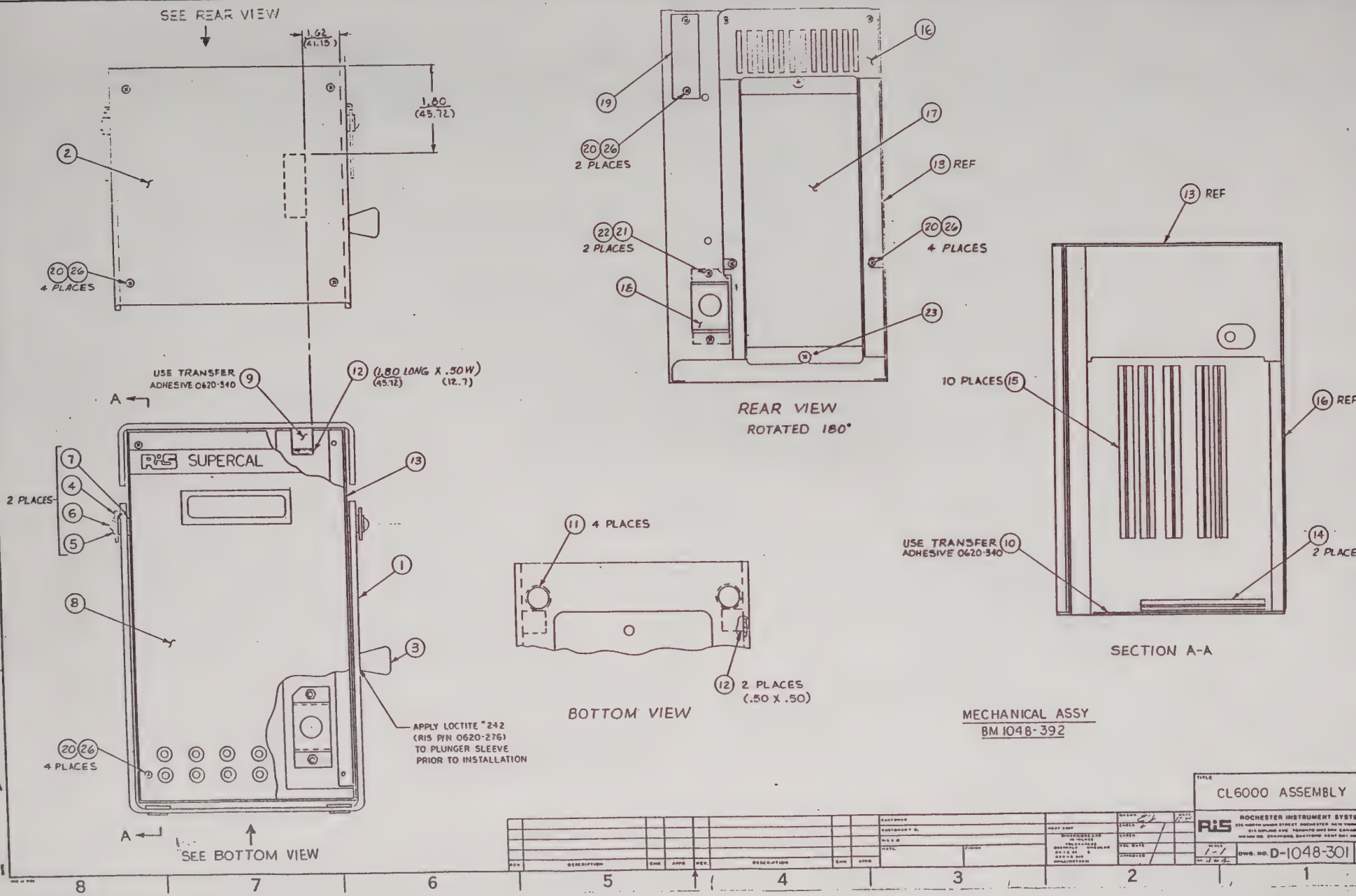
CL6012 BATTERY PACK

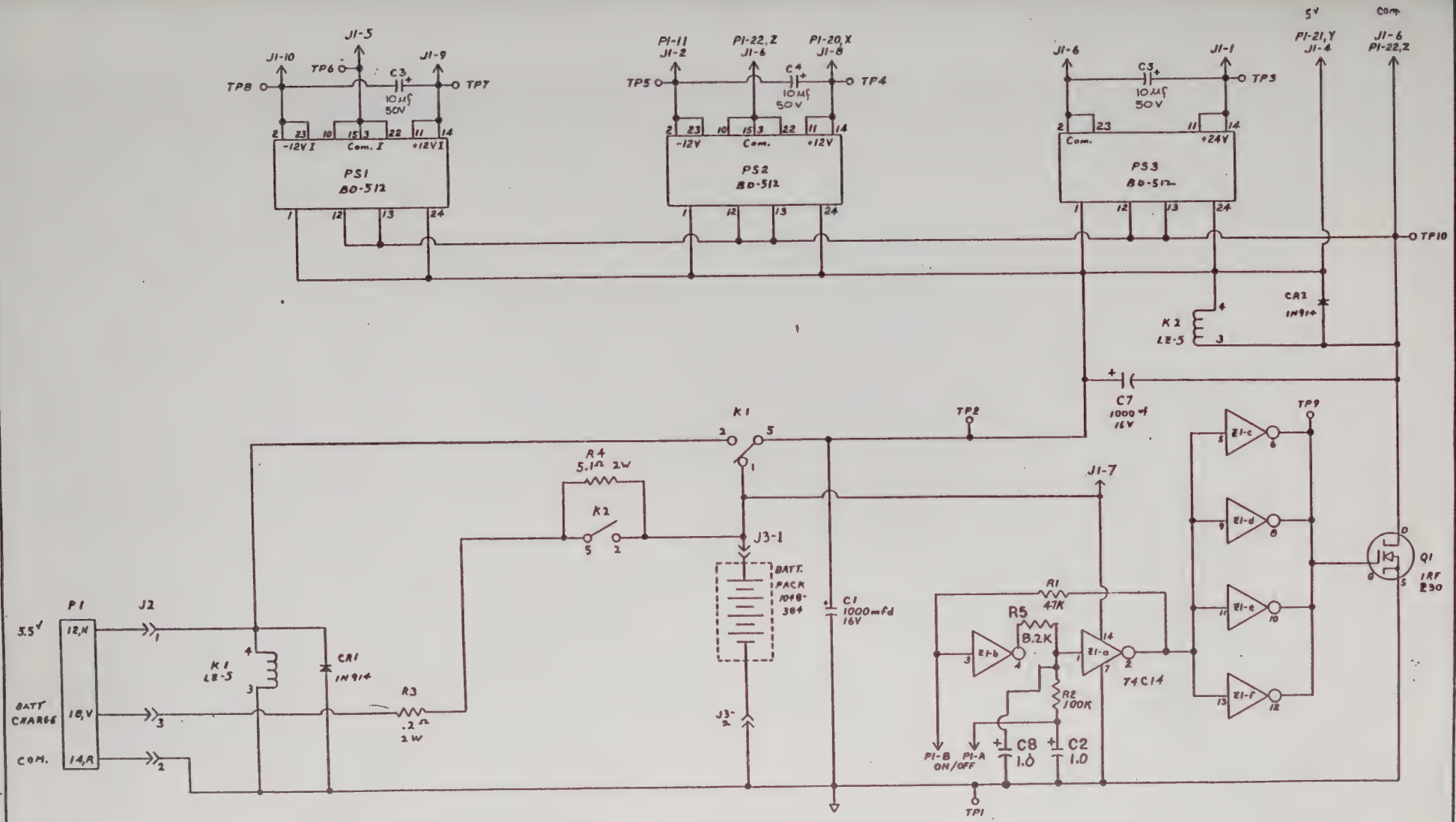
ITEM #	DESCRIPTION	RIS STOCK #	QUAN PER	RV LV	REC QTY
ITEM 1 - B1	BATTERY PACK 4AMP-HRS	0620-445	1.0 EA	A	1
ITEM 6	6-32X3/8 PP MS CAD	0627-034	4.0 EA	A	
ITEM 7	6-32-KEPS NUTS CAD	0627-057	4.0 EA	A	
ITEM 2 ASS'Y B1052-350	BATTERY PACK COVER	1048-399	1.0 EA	A	
ITEM 3	COVER, VAC. FORMED	1051-601	1.0 EA	A	
ITEM 5	CON HDW SOCKET HOUSING	4002-501	1.0 EA	A	
ITEM 4	CON HDW REEL PIN SOCKET	4195-032	2.0 EA	A	

7.0 SCHEMATIC DIAGRAMS AND ASSEMBLY DRAWINGS

TABLE OF CONTENTS

TITLE/DESCRIPTION	DRAWING NUMBER
Supercal Mechanical Assembly	D-1048-301
Power Supply PCB	D-1048-320
CPU PCB	B-1048-304(C1-6002) or D-1055-536 (CL-6008)
Analog Out PCB	D-1048-310
Analog INT PCB	D-1048-315
Analog I/O PCB	D-1048-351
Motherboard	D-1048-360
Remote Charger/Supply	A-1052-193
Battery Pack	B-1052-350
Battery Charger	D-1052-629


SEE REAR VIEW
1.62 (41.15)
1.80 (45.72)
2
20 26 4 PLACES
USE TRANSFER ADHESIVE 0620-340
9
12 (1.80 LONG X .50W) (45.72) (12.7)
A
SUPERCAL
7
4
6
5
2 PLACES
13
1
8
3
20 26 4 PLACES
APPLY LOCTITE "242 (RIS P/N 0620-276) TO PLUNGER SLEEVE PRIOR TO INSTALLATION
SEE BOTTOM VIEW
16
19
20 26 2 PLACES
17
13 REF
22 21 2 PLACES
20 26 4 PLACES
18
23
REAR VIEW ROTATED 180°
11 4 PLACES
12 2 PLACES (.50 X .50)
BOTTOM VIEW
13 REF
10 PLACES 15
16 REF
USE TRANSFER ADHESIVE 0620-340 10
14 2 PLACE
SECTION A-A
MECHANICAL ASSY
BM 1048-392
CL6000 ASSEMBLY
ROCHESTER INSTRUMENT SYST
DWG. NO. D-1048-301



RELAYS K1 AND K2 SHOWN IN DE-ENERGIZED STATE

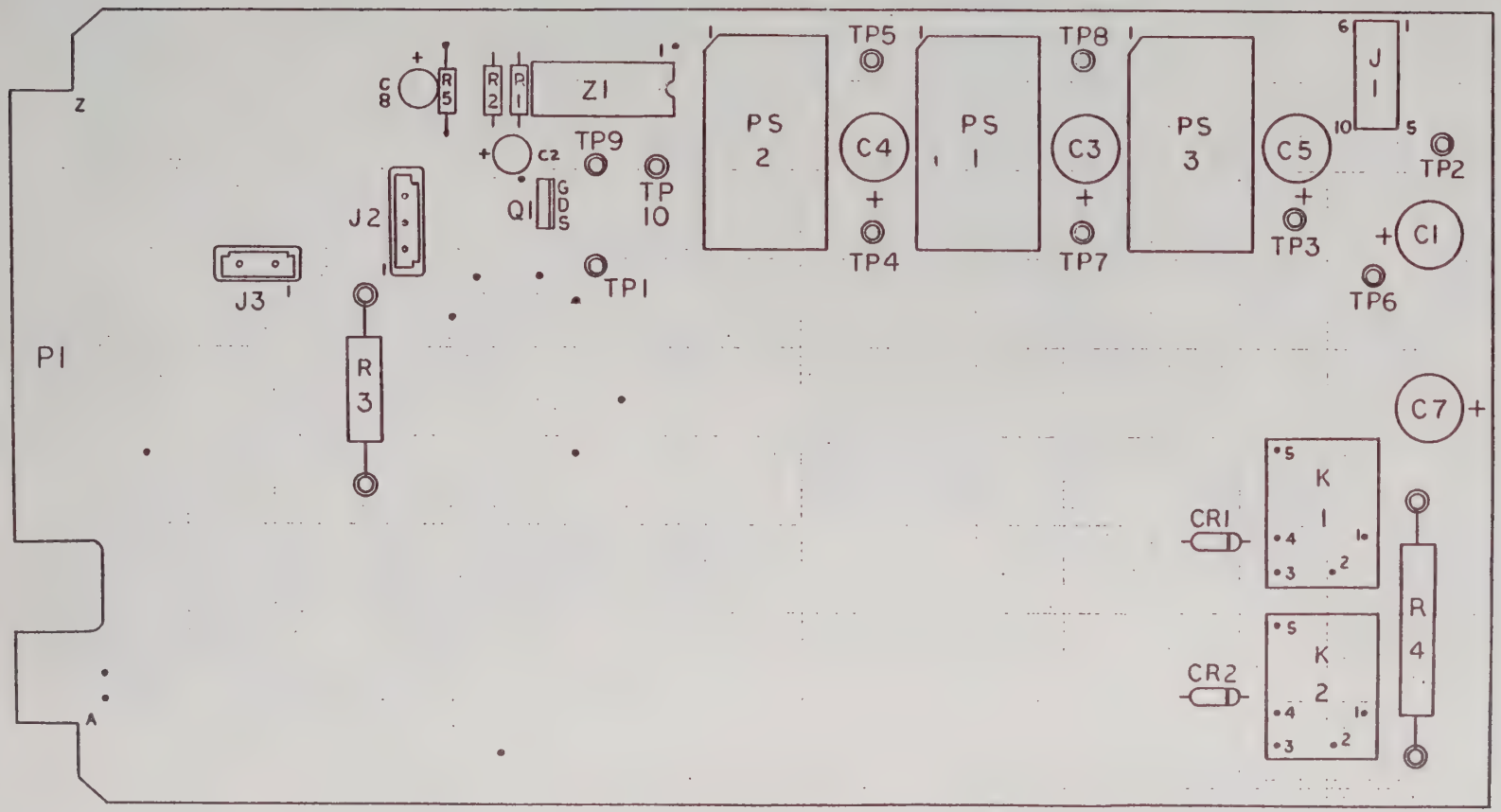
				D	DCO-004936 6/85 DGA			CUSTOMER		DRAWN MC	8378 1083
				C	DCO-004300, dtd 11-26-84			CUSTOMER P.O.		CHECK	
F	DCO-005921, dtd 6-11-86	6/86	KPM	B	DCO-003771, dtd 6-20-84	6/84		PIS S.O.	NEXT ASSY.	CHECK	
E	DCO 5092 DGA 7.23.85			A	NEW RELEASE	—	—	MATL.	FINISH	APL DATE	

DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX ± .01 ±
.XXX ± .005 ±

TITLE
CL 6001
POWER SUPPLY
S+A

RIS
ROCHESTER INSTRUMENT SYSTEMS
295 NORTH UNION STREET, ROCHESTER, NEW YORK 14605
915 KIPLING AVE., TORONTO M8Z 5H4, CANADA
MARLIN RD., CRAYFORD, DARTFORD, KENT DA1 4BD, U.K.

SCALE 2:1 | DWG NO C-1048-720 | REV. F



REV.	DESCRIPTION	CHK.	APPR.	REV.	DESCRIPTION	CHK	APPR.

CUSTOMER

CUSTOMER P. O.

MFG O. O.

MATL. FINISH

NEXT ASSY.

DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.RR = ± .00
.RRR = ± .010
(MILLIMETERS)

DRAWN DATE 1/69

CHECK

CHECK

REL. DATE

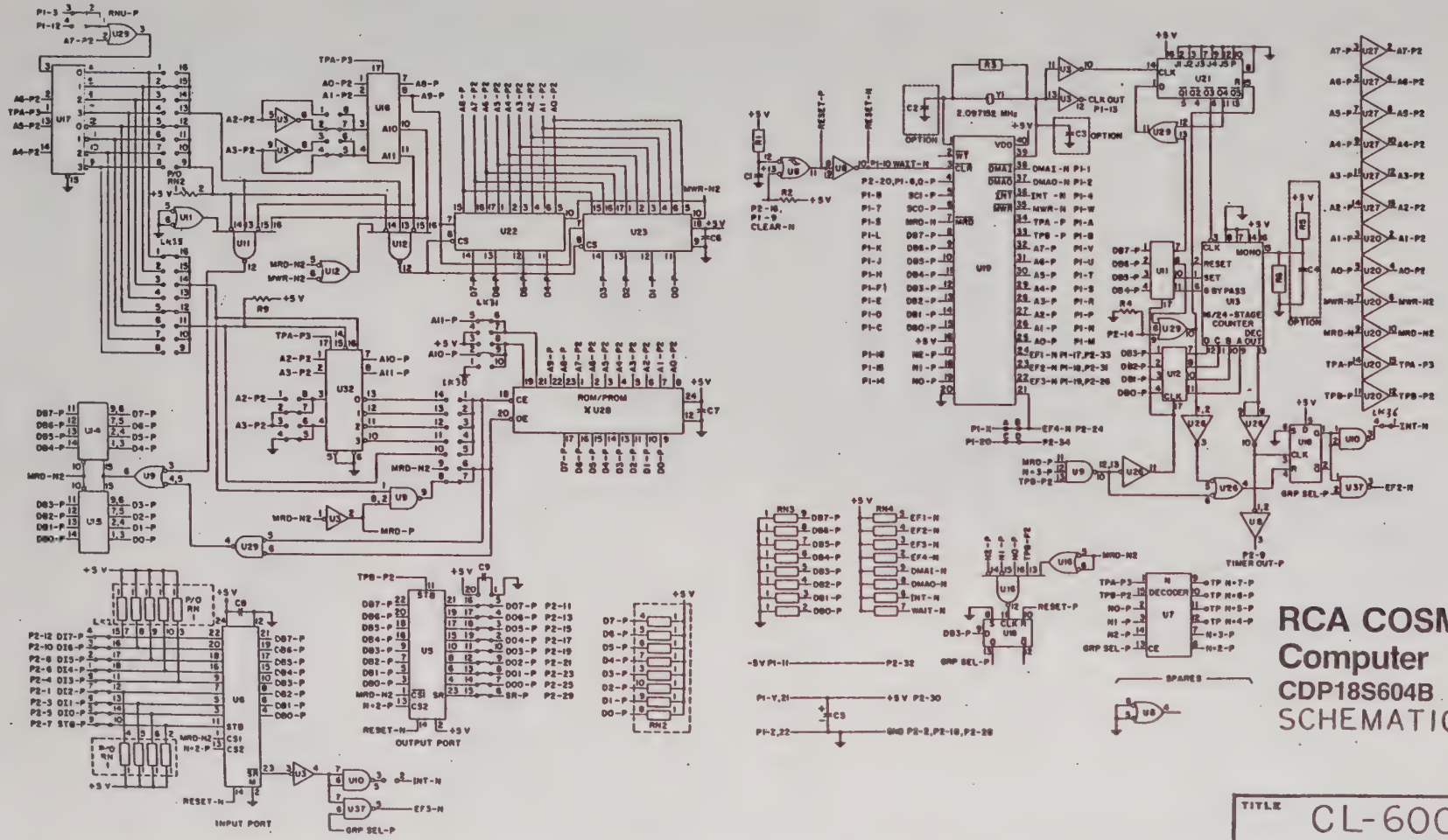
APPROVED

TITLE
CL 6001
POWER SUPPLY
S+A

ROCHESTER INSTRUMENT SYSTEMS
255 NORTH UNION STREET, ROCHESTER, NEW YORK 14
915 KIPLING AVE., TORONTO M8Z 5H4, CANADA
MAXIM RD., CRAYFORD, DARTFORD, KENT DA1 4QB, U.

SCALE 2:1
SH 2 OF 2

DWG. NO. C-1048-320 REV F



RCA COSMAC Microboa
Computer
CDP18S604B
SCHEMATIC

REV.	DESCRIPTION	CHK.	APPR.	CUSTOMER	BM:1048-305	DRAWN	DATE 1/4/75
				CUSTOMER P. O.	NEXT ASSY.	CHECK	
				RIS S. O.	DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS ANGULAR .XX ± .02 & .XXX ± .010 (MILLIMETERS)	CHECK	
				MATL.	FINISH	REL. DATE	
						APPROVED	1/7/75

TITLE: CL-6002 CPU S+A

ROCHESTER INSTRUMENT SYSTE
255 NORTH UNION STREET, ROCHESTER, NEW YORK
915 KIPLING AVE., TORONTO M8Z 5H4, CANADA
MAXIM RD., CRAYFORD, DARTFORD, KENT DA1 4BG

SCALE | DWG. NO. B-1048-304

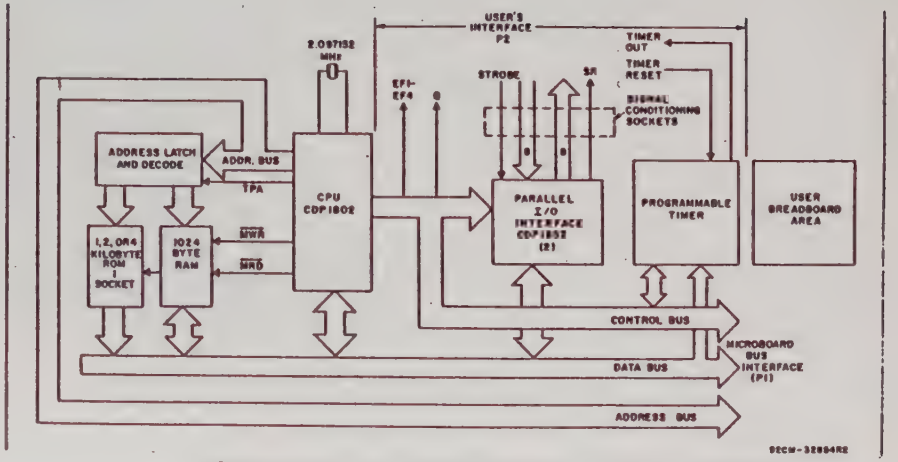
SH 1 OF 5

Pin Terminals and Signals for the RCA COSMAC Microboard Universal Backplane Connector (P1)

Wire Side				Component Side			
Pin	Mnemonic	Signal Flow	Description	Pin	Mnemonic	Signal Flow	Description
A	TPA-P	Out	System Timing Pulse 1	1	DMAI-N	In	DMA Input Request
B	TPB-P	Out	System Timing Pulse 2	2	DMAO-N	In	DMA Output
C	DB0-P	In/Out	Data Bus	3	RNU-P	—	Run Utility Request
D	DB1-P	In/Out	Data Bus	4	INT-N	In	Interrupt Request
E	DB2-P	In/Out	Data Bus	5	MRD-N	Out	Memory Read
F	DB3-P	In/Out	Data Bus	6	Q-P	Out	Programmed Output Latch
H	DB4-P	In/Out	Data Bus	7	SC0-P	Out	State Code
J	DB5-P	In/Out	Data Bus	8	SC1-P	Out	State Code
K	DB6-P	In/Out	Data Bus	9	CLEAR-N	In	Clear-Mode Request
L	DB7-P	In/Out	Data Bus	10	WAIT-N	In	Wait-Mode Request
M	A0-P	Out	Multiplexed Address Bus	11	−5V/−15V	—	Auxiliary Power
N	A1-P	Out	Multiplexed Address Bus	12	SPARE	—	Not Assigned
P	A2-P	Out	Multiplexed Address Bus	13	CLOCK OUT	Out	Clock from CPU Osc.
R	A3-P	Out	Multiplexed Address Bus	14	N0-P	Out	I/O Primary Address
S	A4-P	Out	Multiplexed Address Bus	15	N1-P	Out	I/O Primary Address
T	A5-P	Out	Multiplexed Address Bus	16	N2-P	Out	I/O Primary Address
U	A6-P	Out	Multiplexed Address Bus	17	EF1-N	In	External Flag
V	A7-P	Out	Multiplexed Address Bus	18	EF2-N	In	External Flag
W	MWR-N	Out	Memory Write Pulse	19	EF3-N	In	External Flag
X	EF4-N	In	External Flag	20	+12V/+15V	—	Auxiliary Power
Y	+5 V	In	+5 V dc	21	+5 V	In	+5 V dc
Z	GND	In	Digital Ground	22	GND	In	Digital Ground

Table 9 — Microboard Computer CDP18S604B Parallel I/O Connector (P2)

Pin	Signal	Pin	Signal
1	DI2-P	2	GND
3	DI1-P	4	DI3-P
5	DI0-P	6	DI4-P
7	STB-P	8	DI5-P
9	TIMER OUT-P	10	DI6-P
11	DO7-P	12	DI7-P
13	DO6-P	14	TIMER RESET-P
15	DO5-P	16	CLEAR-N
17	DO4-P	18	GND
19	DO3-P	20	Q-P
21	DO2-P	22	SPARE
23	DO1-P	24	EF4-N
25	DO0-P	26	EF3-N
27	SPARE	28	GND
29	SR-P	30	+5 V
31	EF2-N	32	+5 V/-15 V
33	EF1-N	34	+12 V/+15 V



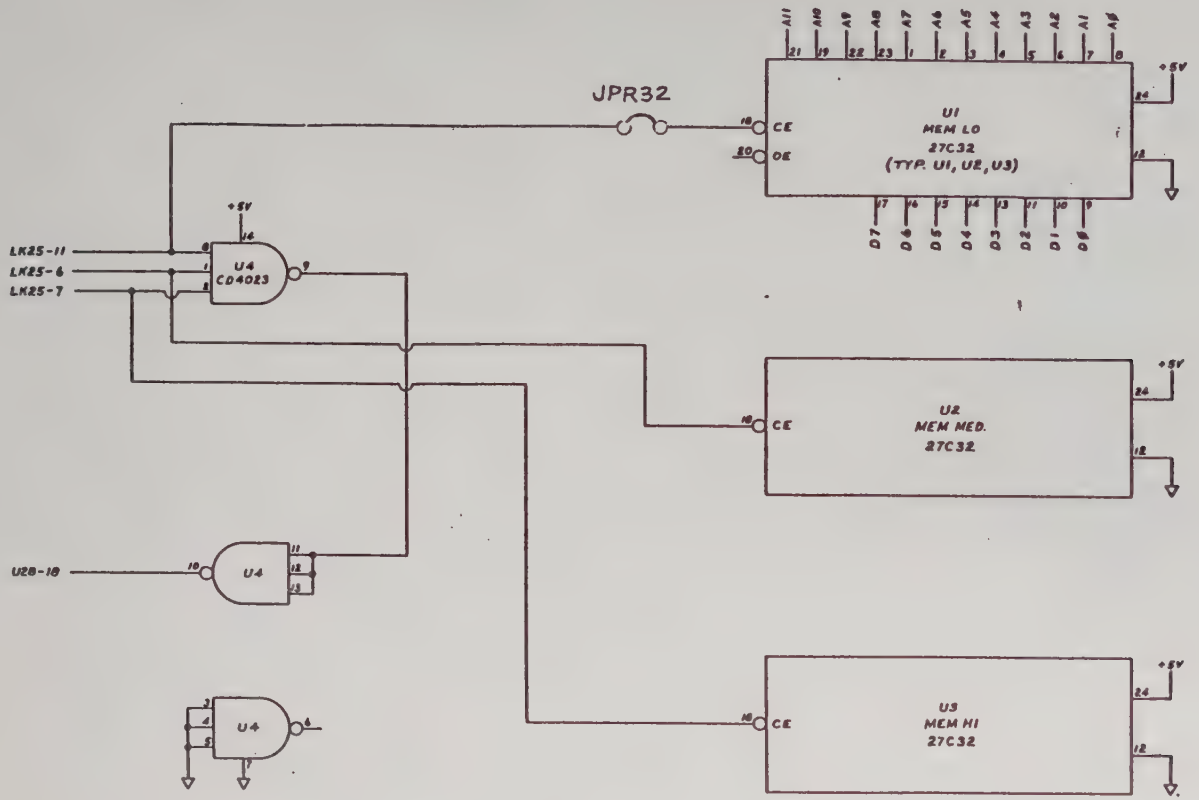
Block Diagram of RCA COSMAC Microboard Computer CDP18S604B

				CUSTOMER		DRAWN	DATE
				CUSTOMER P. O.	NEXT ASSY.	CHECK	
				RIS S. O.	DIMENSIONS ARE IN INCHES TOLERANCES DECIMALS ANGULAR .XX = ± .02 ± .XXX = ± .010 (MILLIMETERS)	CHECK	
				MATL.	FINISH	REL. DATE	
						APPROVED	
V.	DESCRIPTION	CHK.	APPR.				

TITLE: CL-6002 CPU S+A

RIS ROCHESTER INSTRUMENT SYSTEMS
255 NORTH UNION STREET, ROCHESTER, NEW YORK 14605
915 KIPLING AVE., TORONTO M8Z 5H4, CANADA
MAXIM RD., CRAYFORD, DARTFORD, KENT DA1 4BG, U.K.

SCALE | DWG. NO. B-1048-304 | REV. A | SH 2 OF 5



1048-376
daughter PCB
configured for
3 27C32 EPROMS

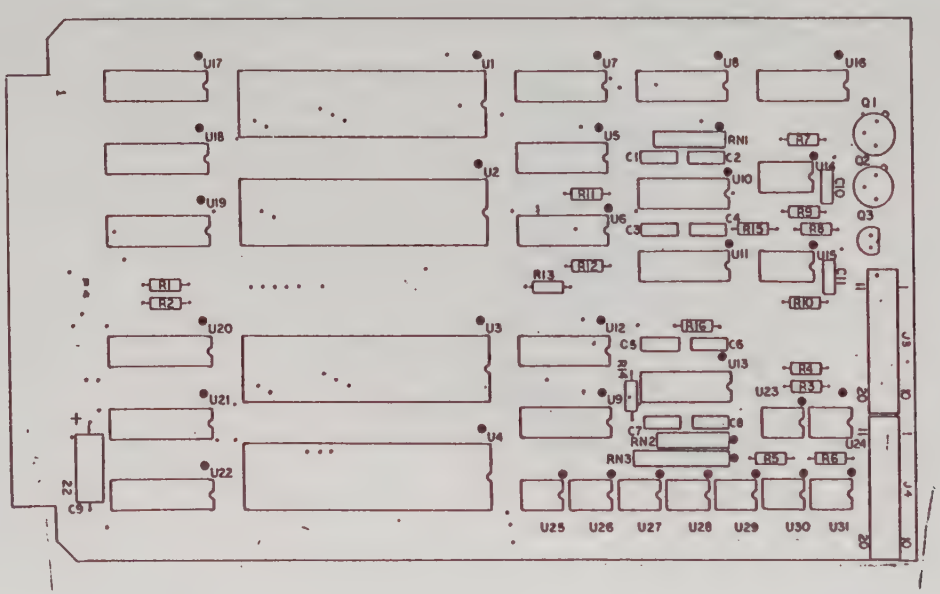
REV.	DESCRIPTION	CHK.	APPR.

CUSTOMER
CUSTOMER P. O.
RIE S. O.
MATL. FINISH
NEXT ASSY.
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX = ± .02 ±
.XXX = ± .010
(MILLIMETERS)
DRAWN DATE
CHECK
CHECK
REL. DATE
APPROVED

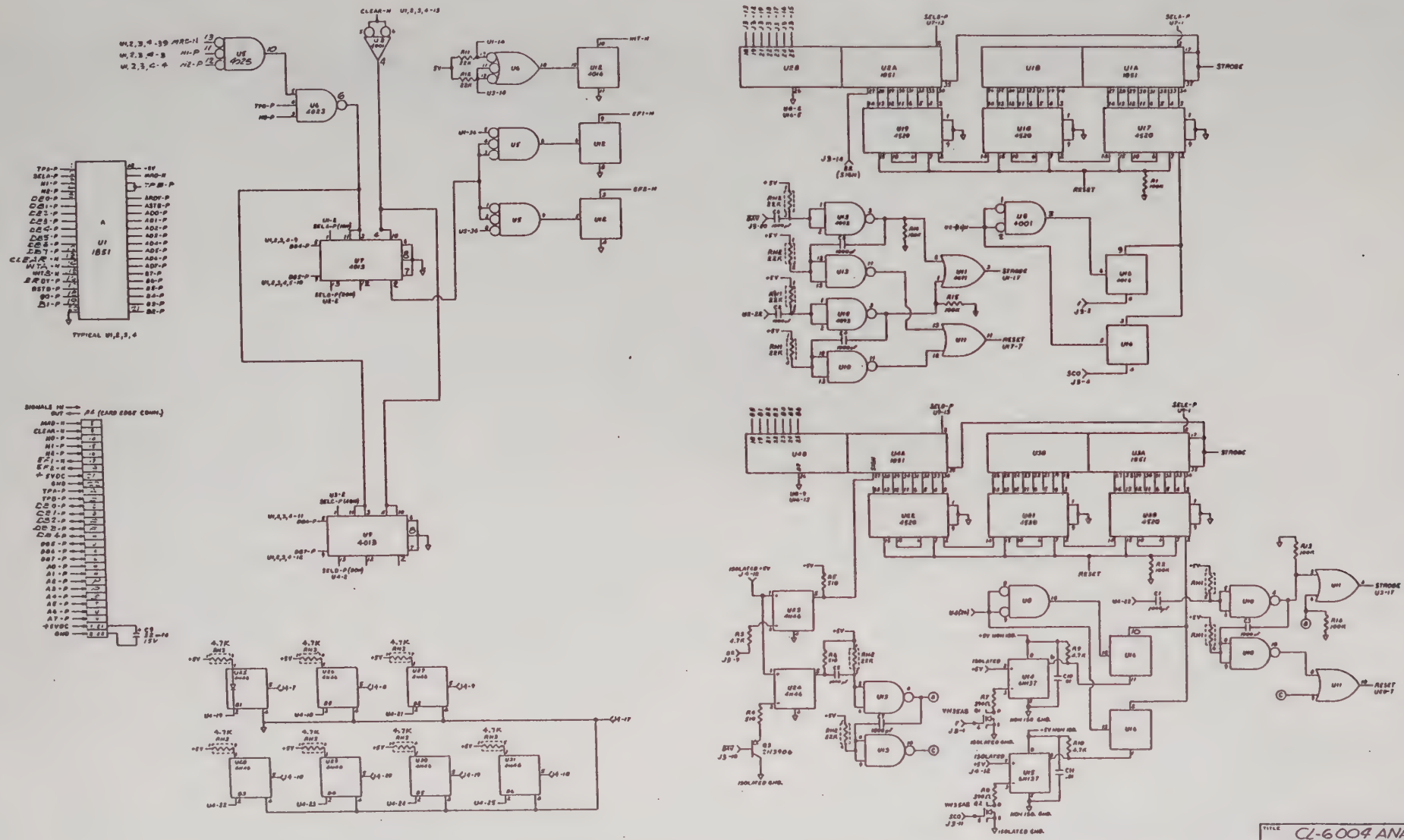
TITLE
CL-6002 CPU
S+A

ROCHESTER INSTRUMENT SYSTEMS
255 NORTH UNION STREET, ROCHESTER, NEW YORK 1460
915 KIPLING AVE., TORONTO M8Z 5H4, CANADA
MAXIM RD., CRAYFORD, DARTFORD, KENT DA1 4BG, U.K

SCALE
SH 3 OF 5
DWG. NO. B-1048-304
REV. A


U17
U1
U7
U8
U16
Q1
U18
U5
RN1
R7
C1
C2
U14
U2
U10
Q2
Q3
U19
R11
U6
C4
R9
C3
R15
R8
U11
U15
R13
R12
C11
R1
R2
R10
U20
U3
U12
R16
C5
C6
U13
R4
U21
U9
U23
R3
C7
C8
U24
RN2
RN3
R5
R6
U22
C9
U25
U26
U27
U28
U29
U30
U31
J3
J4

| | | |



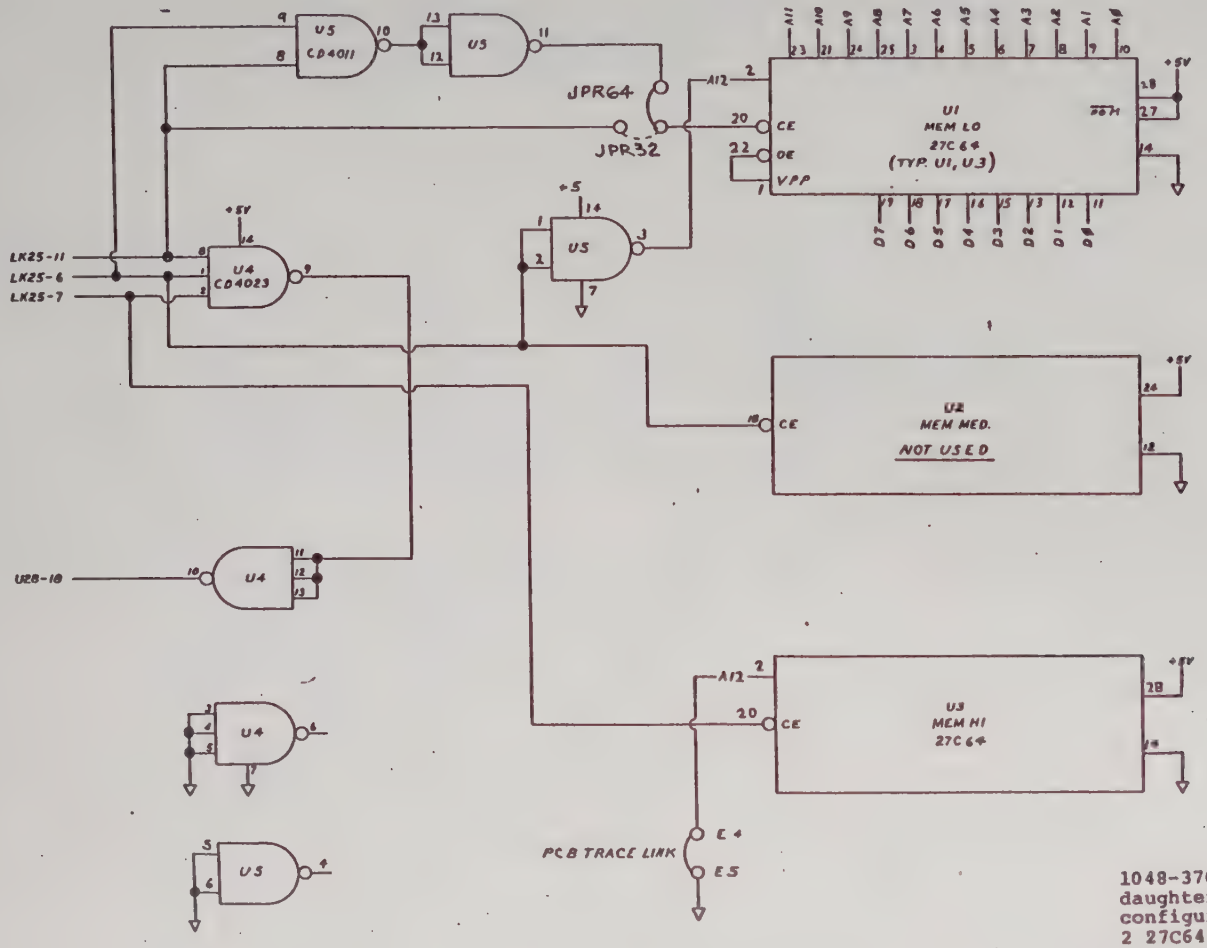
REV	DESCRIPTION	CHG.	APPD.
A	NEW RELEASE		

TITLE: CL-6004 ANALOG INTERFACE CARD SCHEMATIC + ASSEMBLY

A-1048-316

ROCHESTER INSTRUMENT SYSTEMS

DWG. NO. D-1048-315



1048-376
daughter PCB
configured for
2 27C64 EPROMS

REV.	DESCRIPTION	CHK.	APPR.

CUSTOMER
CUSTOMER P. O.
RIS S. O.
MATL.
FINISH
NEXT ASSY.
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX = ± .02° ±
.XXX = ± .010
(MILLIMETERS)
DRAWN
CHECK
CHECK
REL. DATE
APPROVED
DATE

TITLE
CL-6002 CPU S+A

ROCHESTER INSTRUMENT SYSTEMS
255 NORTH UNION STREET, ROCHESTER, NEW YORK
915 KIPLING AVE., TORONTO M8Z 5H4, CANADA
MAXIM RD., CRAYFORD, DARTFORD, KENT DA1 4E

SCALE
SH 4 OF 5
DWG. NO. B-1048-304

MODIFICATION PROCEDURE (NOTE 1)

Step	Operation	Material	Origin	Destination
1.	Trace Cut	PCB	LK30-6	LK30-9
2.	Trace Cut	PCB	LK30-1	LK30-14
3.	Jpr. Cut	.3" Jpr.	LK31-7	LK31-4
4.	Add Jpr. 4	.3" Jpr.	LK30-7	LK30-8
5.	Add Jpr. 5	.3" Jpr.	LK31-6	LK30-5
6.	Add Jpr. 6	.3" Jpr.	LK36-4	LK36-1
7.	Connect JPR1	#22 AWG Wire	E1	LK25-7
8.	Connect JPR2	#22 AWG Wire	E2	LK25-6
9.	Connect JPR3	#22 AWG Wire	E3	LK25-11
10.	Connect	A1048-377	JPR7	XU28

Notes:

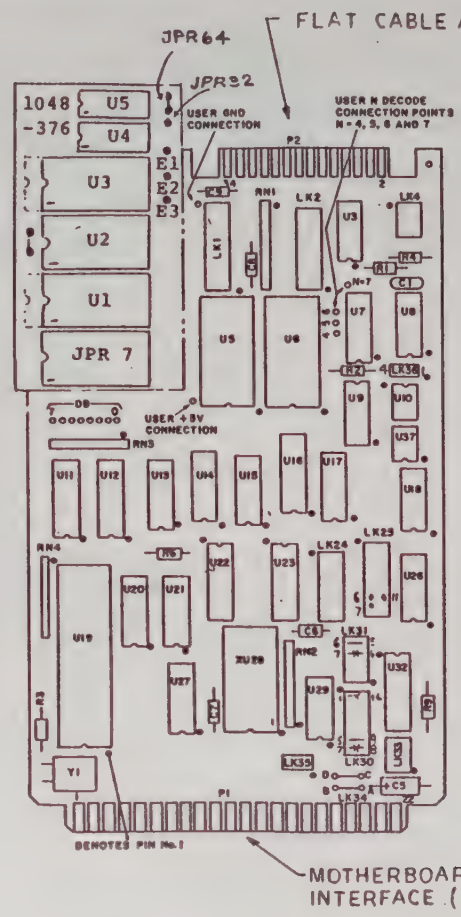
1. CMOS anti-static procedures should be observed during modification procedure, and the unit should be returned to its anti-static bag until final assembly.

2. JRP7 is soldered to the 1048-376 sub-assembly prior to mounting the sub-assembly on the CL6002 PCB.

3. Daughter PCB 1048-376:

   a. U5 & JPR64 are used only when EPROM's are type 27C64.
   b. U2 & JPR32 are used only when EPROM's are type 27C32.

   Refer to Dwg. A-1048-364 for details.



REV	DESCRIPTION	CHK.	APPR.

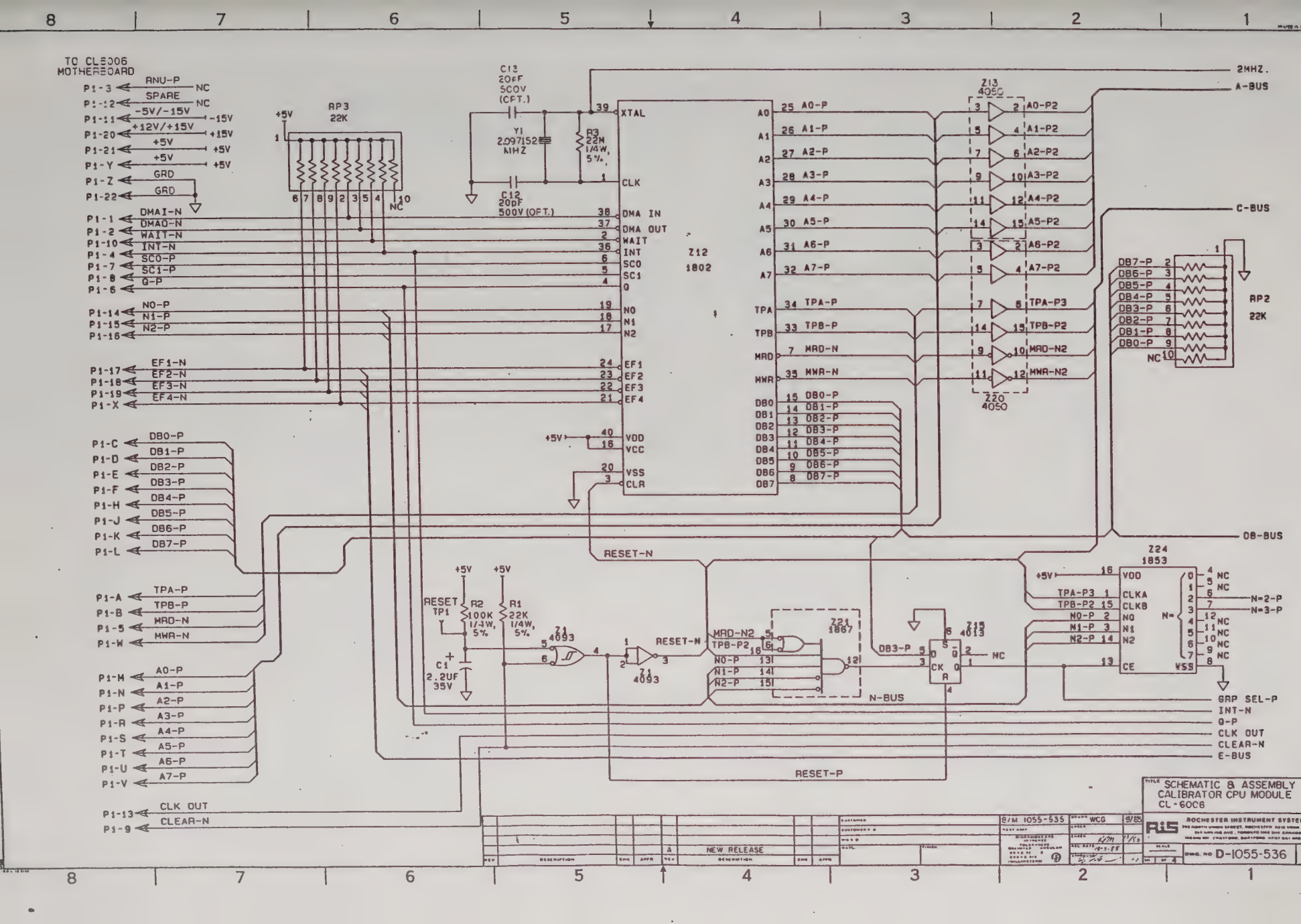
CUSTOMER
CUSTOMER P. O.
RIS S. O.
MATL. | FINISH
NEXT ASSY.
DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX = ± .02 ±
.XXX = ± .010
(MILLIMETERS)
DRAWN | DATE
CHECK
CHECK
REL. DATE
APPROVED

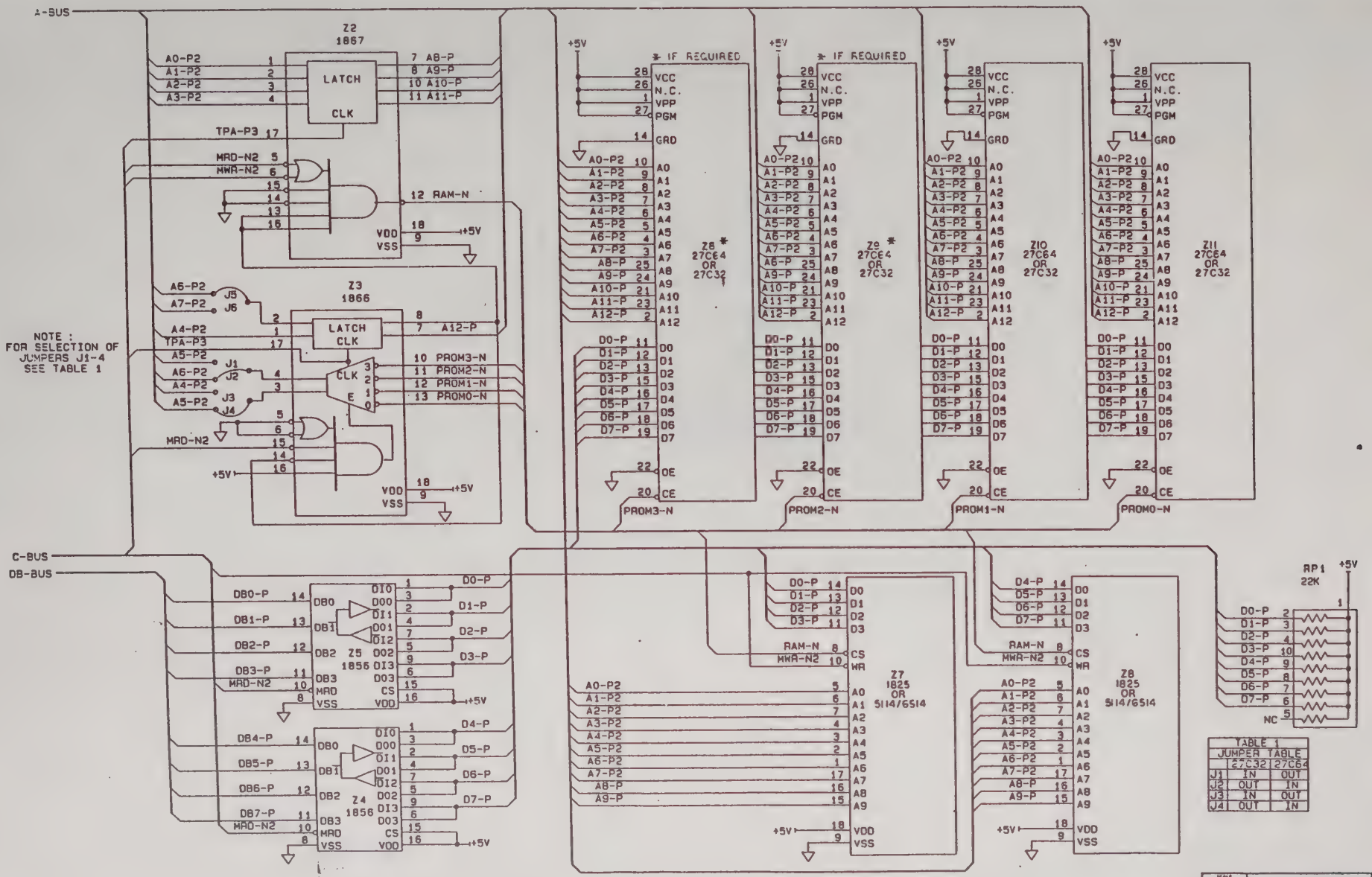
TITLE: CL-6002 CPU
S+A

ROCHESTER INSTRUMENT SYSTEMS
255 NORTH UNION STREET, ROCHESTER, NEW YORK
915 KIPLING AVE., TORONTO M8Z 5H4, CANADA
MAXIM RD., CRAYFORD, DARTFORD, KENT DA1 4BG

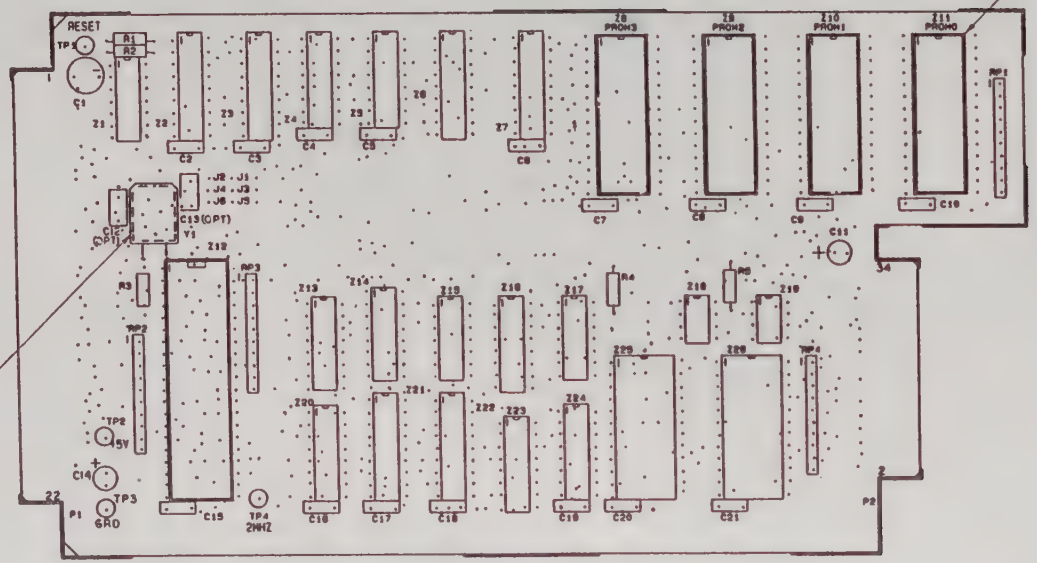
SCALE
SH 5 OF 5
DWG. NO. B-1048-304

TIMER
INPUT PORT
OUTPUT PORT
I/O P2
2MHZ.
2MHZ. TP4
+5V
C-BUS
DB-BUS
E-BUS
CLK OUT
N=3-P
GRP SEL-P
INT-N
Q-P
CLEAR-N
N=2-P
TIMER RESET-P
TIMER OUT-P
GRD.
D-1055-536

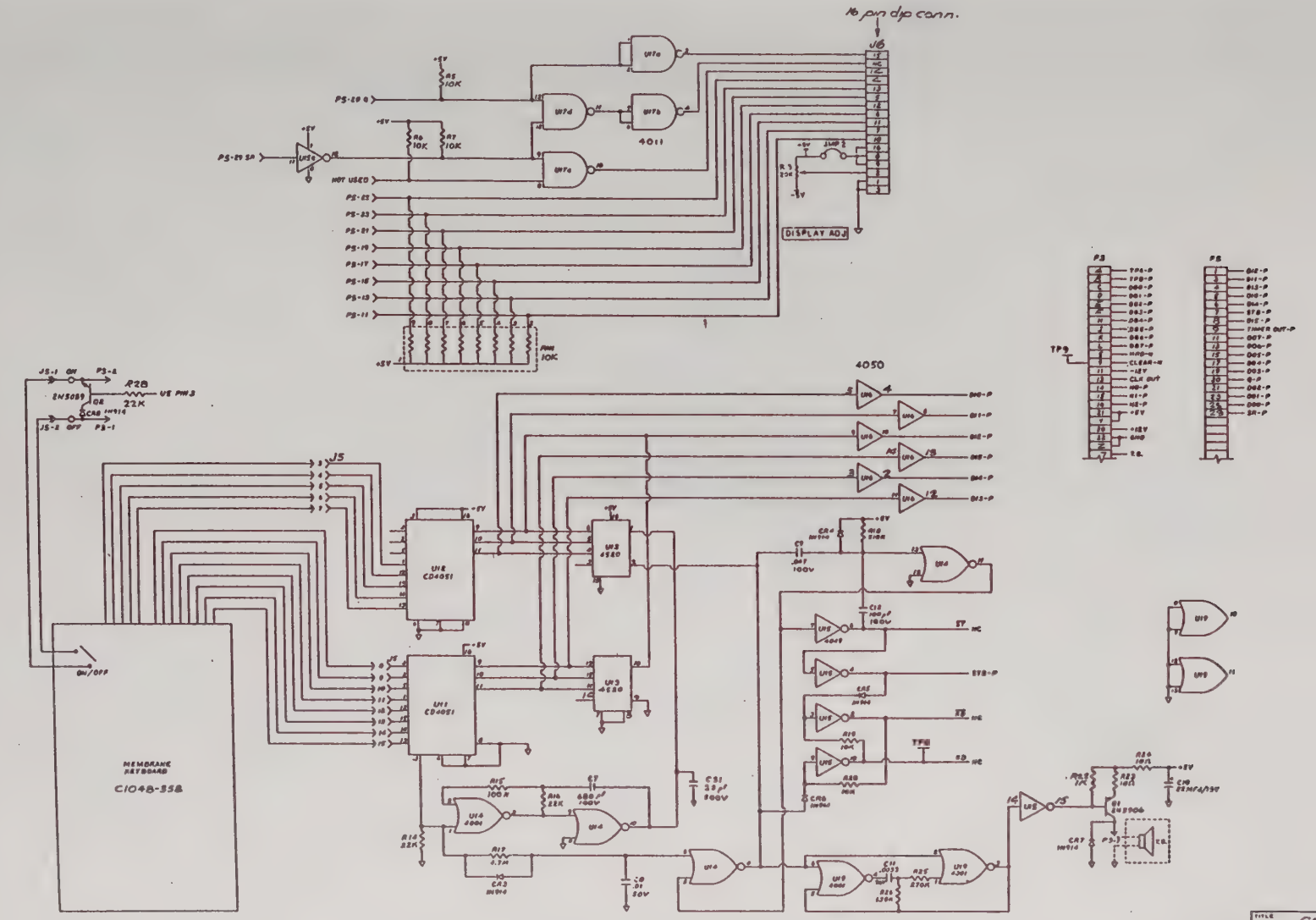

TO CL6006 MOTHERBOARD
P1-3 RNU-P NC
P1-12 SPARE NC
P1-11 -5V/-15V -15V
P1-20 +12V/+15V +15V
P1-21 +5V +5V
P1-Y +5V +5V
P1-Z GRD
P1-22 GRD
RP3 22K
C13 20PF 500V (OPT.)
Y1 2.097152 MHZ
R3 22M 1/4W, 5%
C12 20PF 500V (OPT.)
Z12 1802
XTAL
CLK
DMA IN
DMA OUT
WAIT
INT
SCO
SC1
Q
NO
N1
N2
EF1
EF2
EF3
EF4
VDD
VCC
VSS
CLR
A0-P
A1-P
A2-P
A3-P
A4-P
A5-P
A6-P
A7-P
TPA-P
TPB-P
MRD-N
MWR-N
DB0-P
DB1-P
DB2-P
DB3-P
DB4-P
DB5-P
DB6-P
DB7-P
Z13 4050
Z20 4050
A0-P2
A1-P2
A2-P2
A3-P2
A4-P2
A5-P2
A6-P2
A7-P2
TPA-P3
TPB-P2
MRD-N2
MWR-N2
RP2 22K
2MHZ.
A-BUS
C-BUS
DB-BUS
P1-1 DMAI-N
P1-2 DMAO-N
P1-10 WAIT-N
P1-4 INT-N
P1-7 SCO-P
P1-8 SC1-P
P1-6 Q-P
P1-14 NO-P
P1-15 N1-P
P1-16 N2-P
P1-17 EF1-N
P1-18 EF2-N
P1-19 EF3-N
P1-X EF4-N
P1-C DB0-P
P1-D DB1-P
P1-E DB2-P
P1-F DB3-P
P1-H DB4-P
P1-J DB5-P
P1-K DB6-P
P1-L DB7-P
P1-A TPA-P
P1-B TPB-P
P1-5 MRD-N
P1-W MWR-N
P1-M A0-P
P1-N A1-P
P1-P A2-P
P1-R A3-P
P1-S A4-P
P1-T A5-P
P1-U A6-P
P1-V A7-P
P1-13 CLK OUT
P1-9 CLEAR-N
RESET-N
RESET TP1
R2 100K 1/4W, 5%
R1 22K 1/4W, 5%
C1 2.2UF 35V
Z1 4093
Z21 1867
Z15 4013
Z24 1853
N-BUS
GRP SEL-P
INT-N
Q-P
CLK OUT
CLEAR-N
E-BUS
RESET-P
N=2-P
N=3-P
NEW RELEASE
SCHEMATIC & ASSEMBLY
CALIBRATOR CPU MODULE
CL-6006
ROCHESTER INSTRUMENT SYSTEMS
DWG. NO D-1055-536


A-BUS
C-BUS
DB-BUS
Z2
1867
LATCH
CLK
A0-P2
A1-P2
A2-P2
A3-P2
7 A8-P
8 A9-P
10 A10-P
11 A11-P
TPA-P3 17
MRD-N2 5
MWR-N2 6
12 RAM-N
VDD 18
VSS 9
+5V
Z3
1866
A5-P2
A7-P2
J5
J6
A4-P2
TPA-P3
A6-P2
A4-P2
J1
J2
J3
J4
A5-P2
7 A12-P
10 PROM3-N
11 PROM2-N
12 PROM1-N
13 PROM0-N
MRD-N2
NOTE :
FOR SELECTION OF
JUMPERS J1-4
SEE TABLE 1
* IF REQUIRED
VCC
N.C.
VPP
PGM
GRD
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
D0
D1
D2
D3
D4
D5
D6
D7
OE
CE
Z6 *
27C64
OR
27C32
PROM3-N
Z9 *
Z10
Z11
PROM2-N
PROM1-N
PROM0-N
Z5
1856
Z4
DB0
DB1
DB2
DB3
MRD
VSS
DI0
DI1
DI2
DI3
DO0
DO1
DO2
DO3
CS
VDD
Z7
1825
OR
5114/6514
Z8
RAM-N
MWR-N2
WR
RP1
22K
NC
TABLE 1
JUMPER TABLE
27C32
27C64
J1 IN OUT
J2 OUT IN
J3 IN OUT
J4 OUT IN
DWG. NO. D-1055-536

NOTE: Z8-Z12 ARE SOCKETED.



LOCATE XY1 BETWEEN Y1 AND PCB

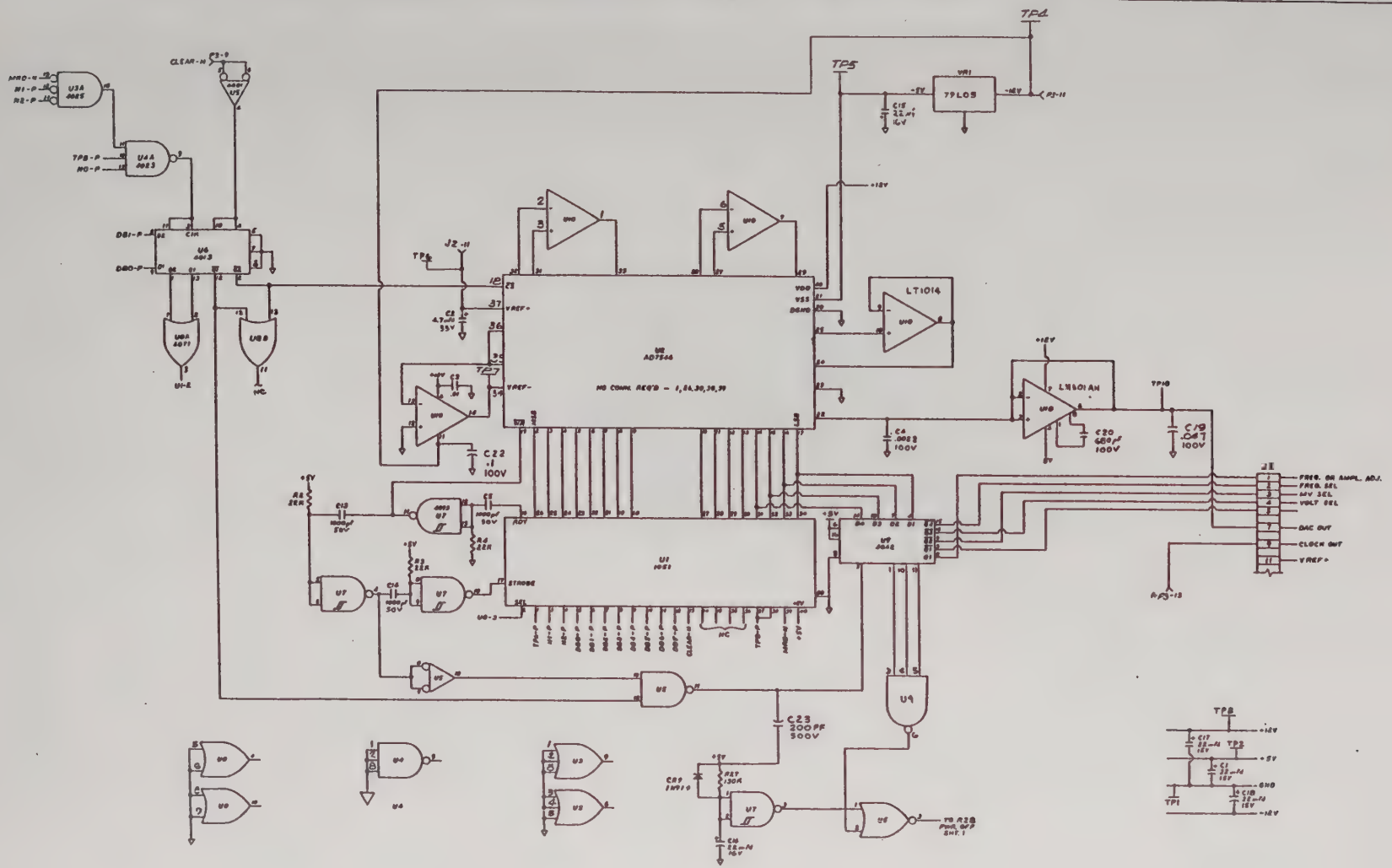


REV	DESCRIPTION	ENG.	APPR.
F	DCO-[illegible]	[illegible]	[illegible]
E	DCO 5334 DCA 1-86	[illegible]	[illegible]
D	DCO-[illegible]	[illegible]	[illegible]
C	DCO 3770 4/28/87	[illegible]	[illegible]
B	DCO 3491 3-21-89 KB	[illegible]	[illegible]
A	NEW RELEASE	–	–
4	DCO 3863 12-15-93	[illegible]	[illegible]

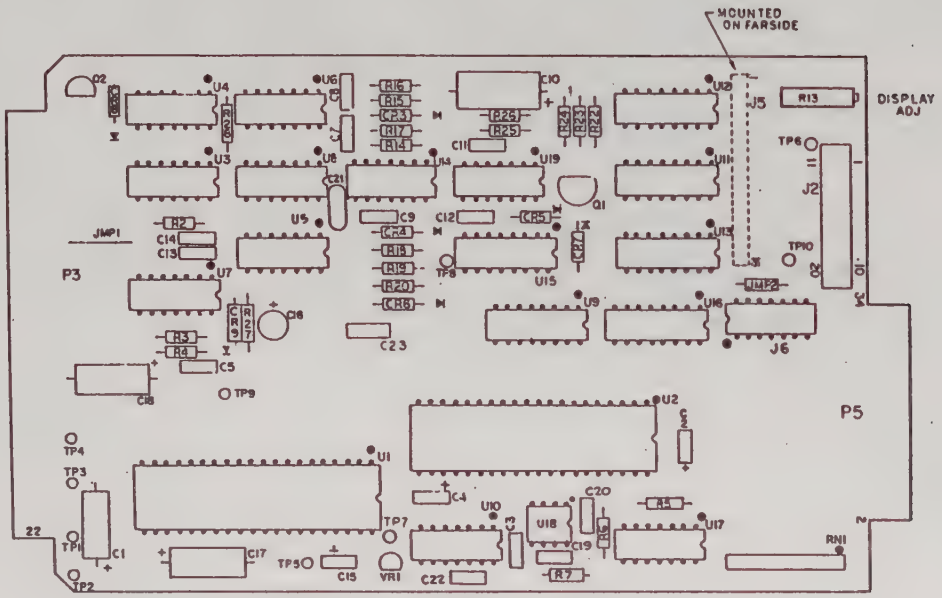
TITLE: CL-6003 ANALOG OUTPUT CARD SCHEMATIC + ASSEMBLY

ROCHESTER INSTRUMENT SYSTEMS

DWG. NO D-1048-310



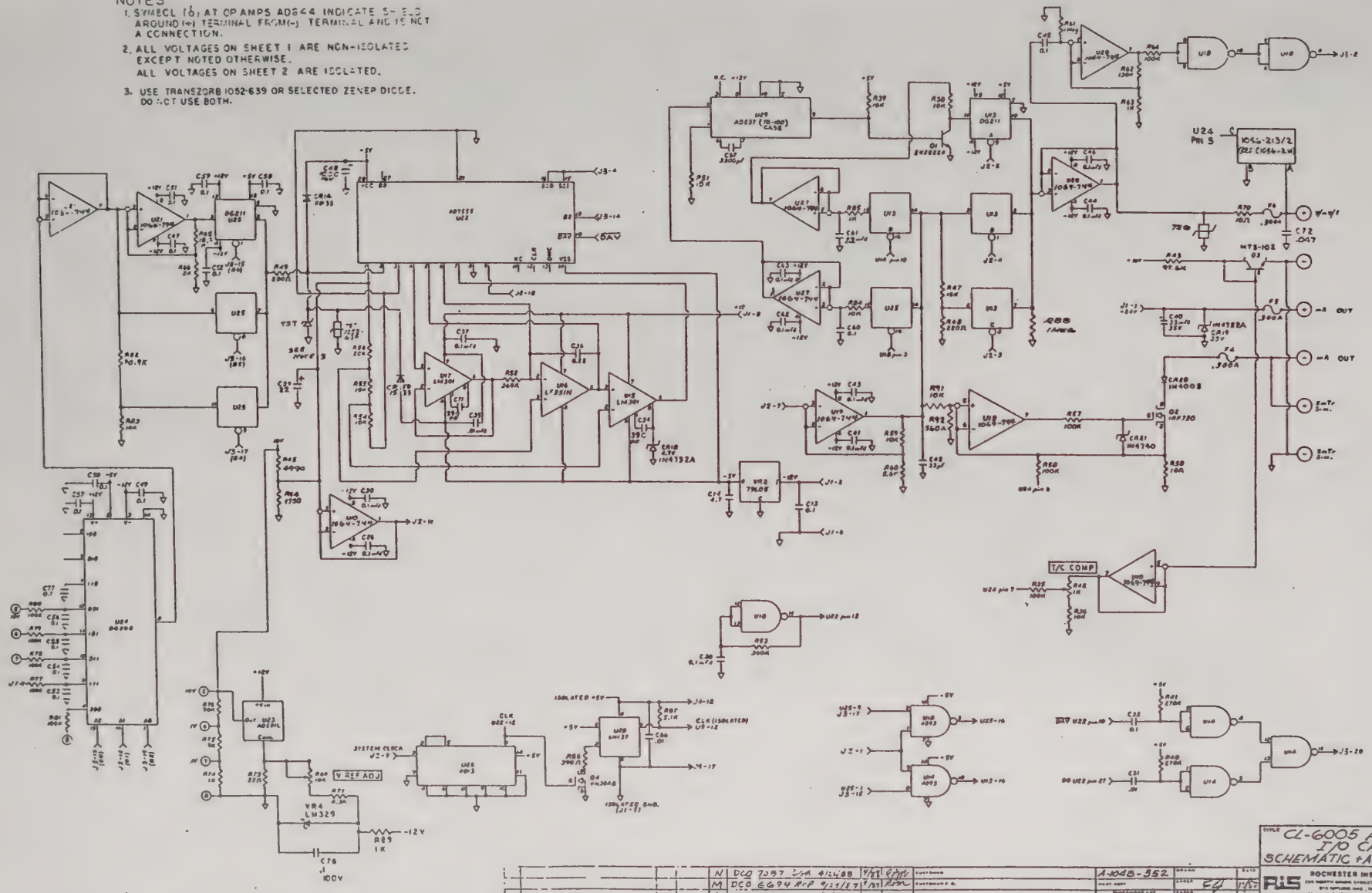
TITLE	
	CI-6003 ANALOG OUTPUT CARD SCHEMATIC & ASSEMBLY
	ROCHESTER INSTRUMENT SYSTEMS
DWG. NO	D-1048-310
REV	F
SHT	2 OF 3



Dwng. no. D-1048-510

NOTES

1. SYMBOL (b) AT OP AMPS AD644 INDICATE SHIELD GROUND (=) TERMINAL FROM (-) TERMINAL AND IS NOT A CONNECTION.
2. ALL VOLTAGES ON SHEET 1 ARE NON-ISOLATED EXCEPT NOTED OTHERWISE. ALL VOLTAGES ON SHEET 2 ARE ISOLATED.
3. USE TRANSZORB 1052-639 OR SELECTED ZENER DIODE. DO NOT USE BOTH.

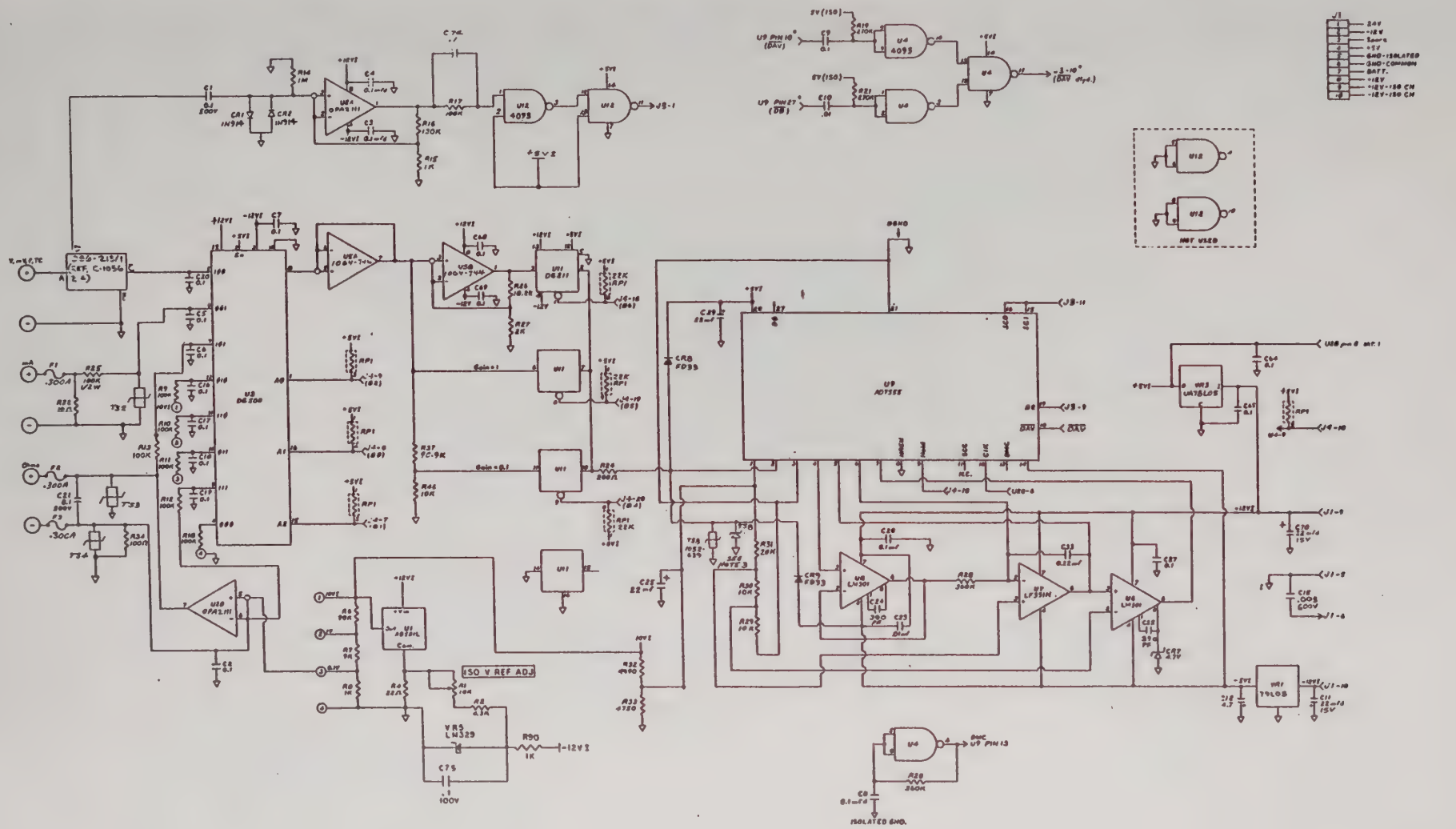


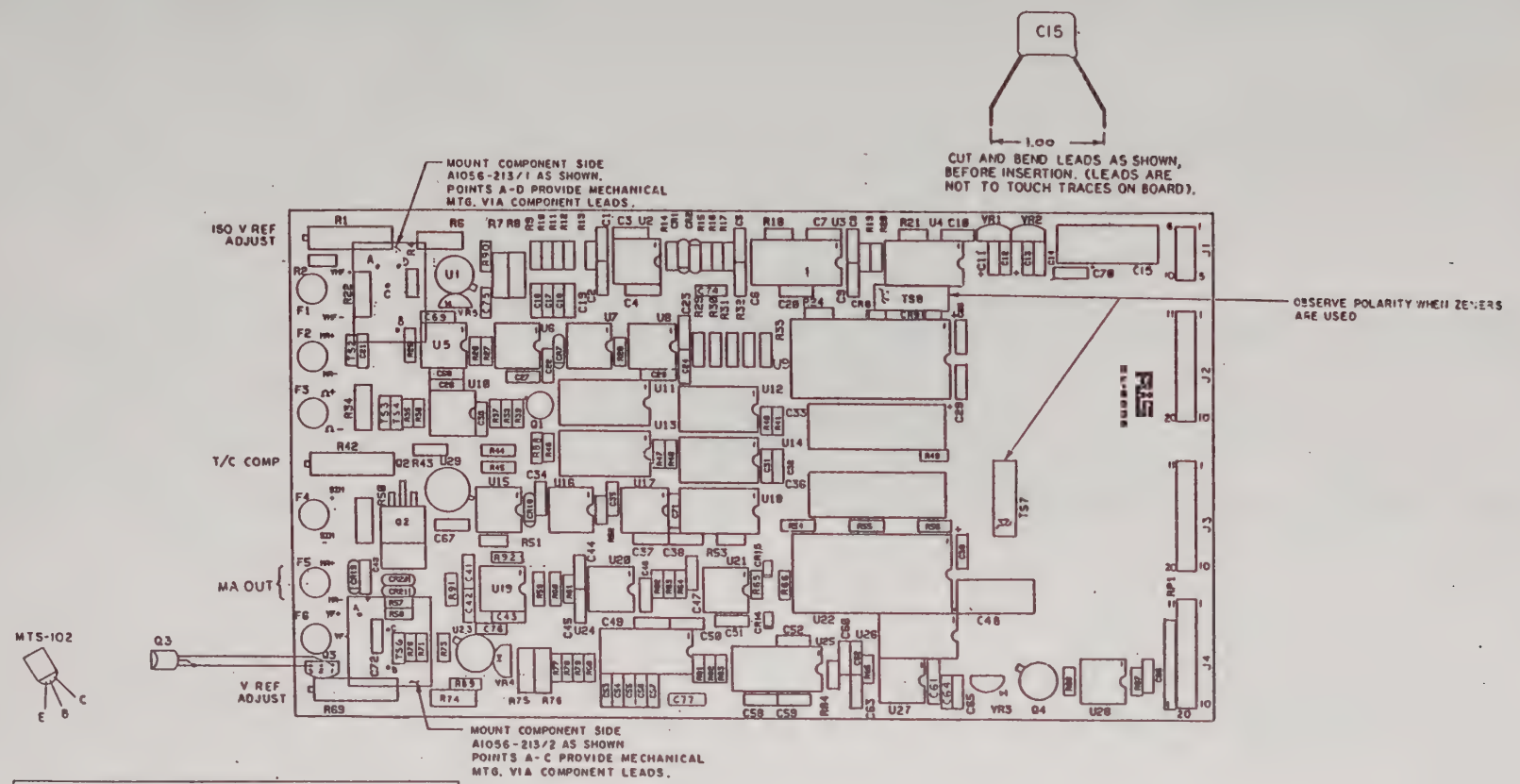
N	DCO 7097 LVA 4/24/88						
M	DCO 6694 RCP 9/25/87						
L	DCO-06C412 JS 3-31-87						
K	DCO 6278 RCP 1-19-87						
P	DCO 7775 KPM 5-31-89						

CL-6005 ANALOG I/O CARD SCHEMATIC ASSEMBLY

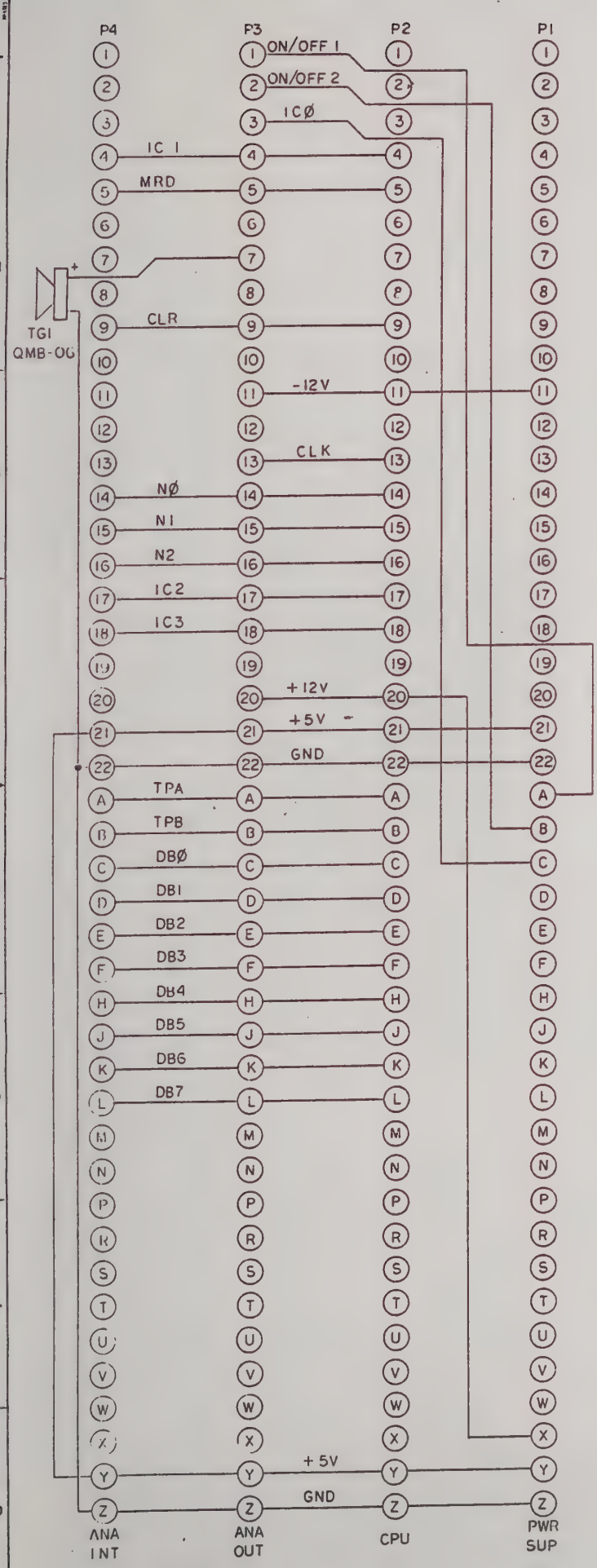
ROCHESTER INSTRUMENT SYSTEMS

DWG. NO D-1048-351 P


150 V REF ADJ
ISOLATED GND.
CL-6005 ANALOG I/O CARD SCHEMATIC + ASSEMBLY
ROCHESTER INSTRUMENT SYSTEMS
D-1048-351


C15
1.00
CUT AND BEND LEADS AS SHOWN, BEFORE INSERTION. (LEADS ARE NOT TO TOUCH TRACES ON BOARD).
MOUNT COMPONENT SIDE A1056-213/1 AS SHOWN. POINTS A-D PROVIDE MECHANICAL MTG. VIA COMPONENT LEADS.
ISO V REF ADJUST
T/C COMP
MA OUT
V REF ADJUST
OBSERVE POLARITY WHEN ZENERS ARE USED
MTS-102
E
B
C
Q3
MOUNT COMPONENT SIDE A1056-213/2 AS SHOWN POINTS A-C PROVIDE MECHANICAL MTG. VIA COMPONENT LEADS.

WIRING LIST			
FROM	TO	COLOR	LENGTH
PC BOARD VMF +	0627-206 LUG	RED	3.5"
MA +			
Ω +			
SIM +			
MA OUT+			
VF +		RED	
VMF −		BLK	
MA −			
Ω −			
SIM −			
MA OUT−			
VF −	0627-206 LUG	BLK	
Q3-1	Q3 REMOTE E	BLK	
PC BOARD Q3-3	Q3 REMOTE B,C	RED	3.5"

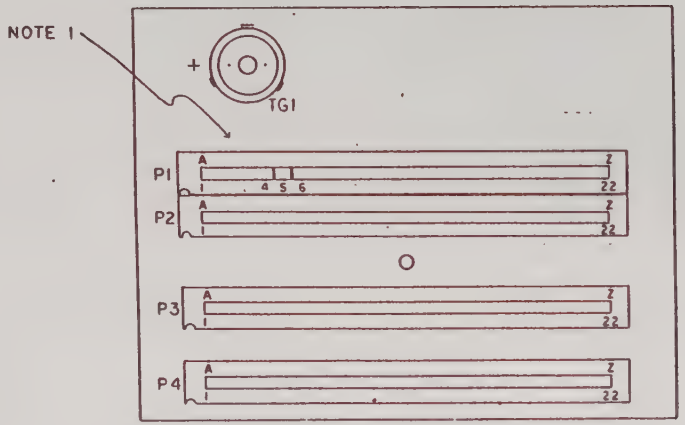


SCHEMATIC & ASSEMBLY
MOTHERBOARD
CL6006

ROCHESTER INSTRUMENT SYSTEMS

DWG NO D-1043-360

A NEW RELEASE



NOTES

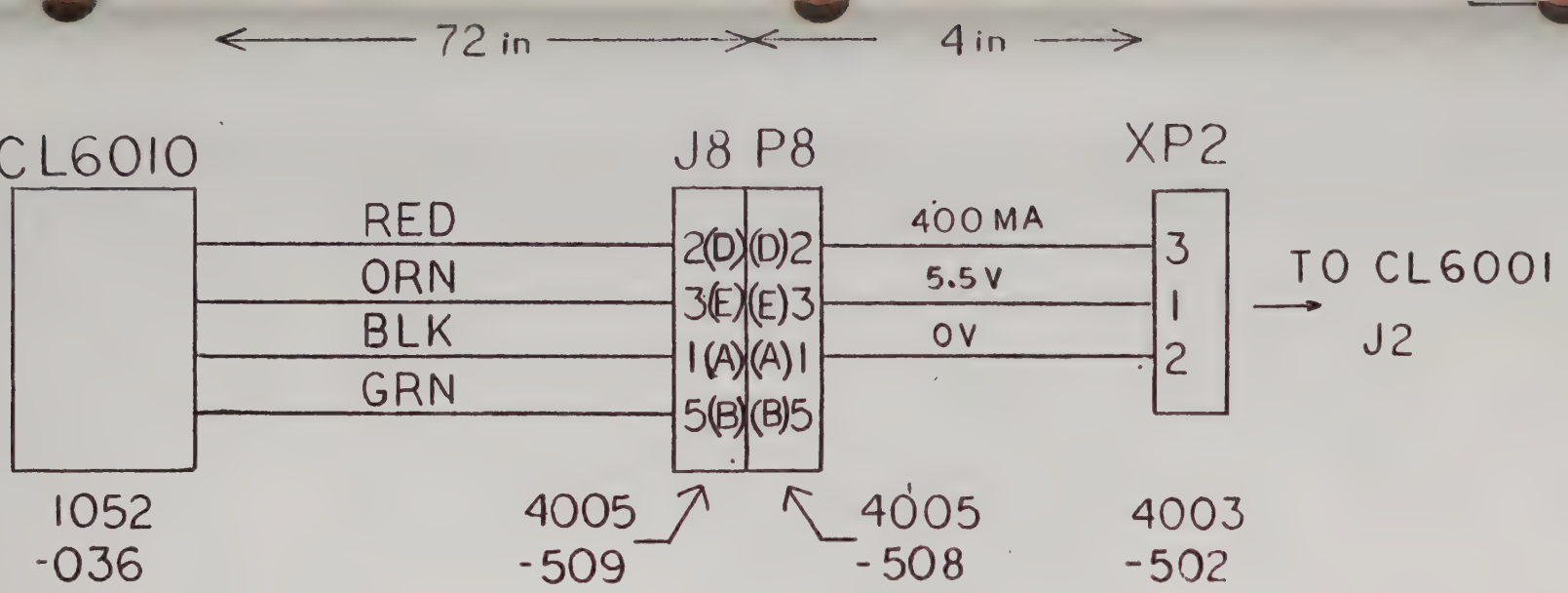
1-KEYING INFORMATION:
INSERT KEY BETWEEN P1 PINS 4 AND 5, 5 AND 6.

SCHEMATIC + ASSEMBL
MOTHERBOARD
CL 6006

ROCHESTER INSTRUMENT SYST

2:1

DWG. NO. D-1048-360



REV.	DESCRIPTION	CHK.	APPR.
B	DCO-003630, 5-2-84	5/84	EJ
A1	DC03274 PSJ 2-2-84	2/84	MEH
A	New Release		

BOM1052-037

NEXT ASSY.

DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS .XX = ±.02 .XXX = ±.010 ANGULAR ±
(MILLIMETERS)

TITLE

CL6010 SUPPLY/ CHARGER ASS'Y

CUSTOMER

CUSTOMER P. O.

RIS S. O.

MATL. | FINISH

DRAWN | DATE 11/83

CHECK

CHECK

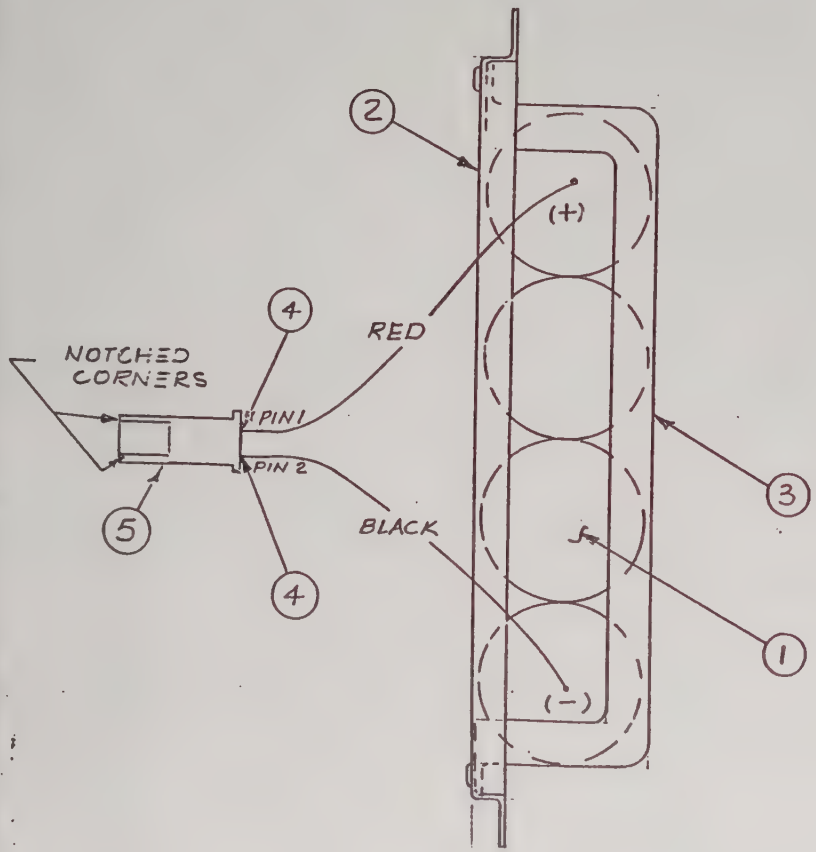
REL. DATE

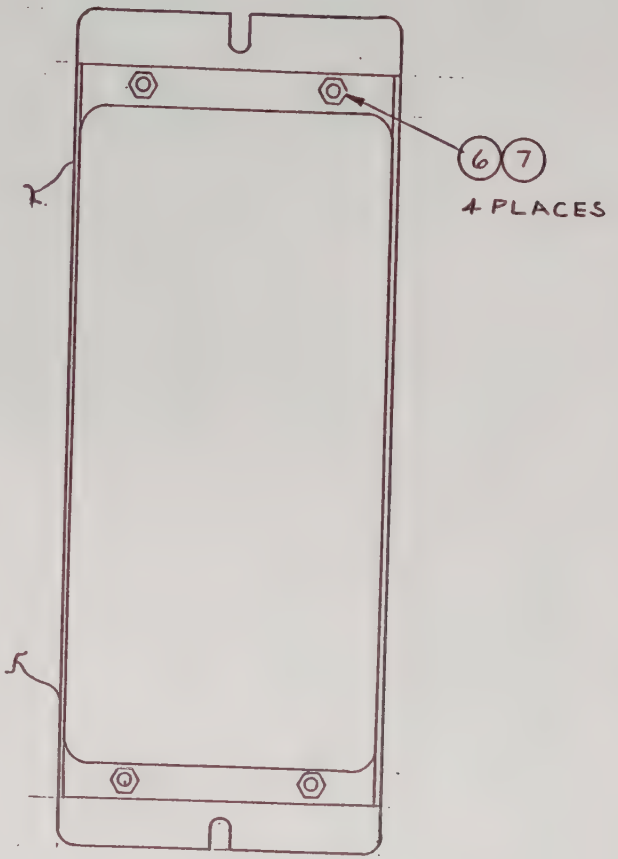
ROCHESTER INSTRUMENT SYSTEMS
255 NORTH UNION STREET, ROCHESTER, NEW YORK 14605
915 KIPLING AVE., TORONTO M8Z 5H4, CANADA
MAXIM RD., CRAYFORD, DARTFORD, KENT DA1 4BG, U.K.

SCALE —

DWG. NO. A 1052-103

REV. B





REV.	DESCRIPTION	CHK.	APPR.
A	NEW RELEASE	—	—

CUSTOMER

CUSTOMER P. O.

HIS S. O.

MATL. | FINISH

BM1048-384

NEXT ASSY.

DIMENSIONS ARE IN INCHES
TOLERANCES
DECIMALS ANGULAR
.XX = ± .02 ±
.XXX = ± .010
[MILLIMETERS]

DRAWN EY 12/83

CHECK EO 12/83

CHECK

REL. DATE

APPROVED 1/5

TITLE
CL6012 BATTERY PACK

ROCHESTER INSTRUMENT SYSTEMS
255 NORTH UNION STREET, ROCHESTER, NEW YORK 1460
915 KIPLING AVE., TORONTO M8Z 5H4, CANADA
MAXIM RD., CRAYFORD, DARTFORD, KENT DA1 4BG, U.K.

SCALE 1-1

DWG. NO. B-1052-350

REV. A

EQUIVALENT COMPONENT REFERENCE GUIDE

Due to conditions beyond our control, it may be necessary to substitute a different part for one called out on the documentation. The use of such an alternate component, which may or may not appear in your product, is covered in the following table. Unless a specific manufacturer is named, the part number is understood to be an industry standard (generic) identification.

Original Part Number	Component Description	Alternate #1	Alternate #2	Comments
1N2070	Diode 400V, 1A	1N4004		
1N914	Diode 75V, 0.2A	1N4148		
20F40	Diode 400V, 20A	MR-2004S		
D40D11	Transistor (NPN)	D40E7		
D41D11	Darlington (PNP) 75V 1A	D41E7		
IVN5000ANF	FET	2N6661		Requires configuration change

PROCEDURES FOR FACTORY REPAIR AND RETURN

A. Call or write RiS with the following information to obtain a Return Material Authorization (RMA) number.

1. Model and Serial Number of the Equipment
2. The failure symptom—BE SPECIFIC
3. The operating environment, i.e., Indoor/ Outdoor, approximate temperature, vibration, dusty conditions, etc.
4. Approximate date of installation or number of operating hours
5. The site name and address of the failed equipment.
6. Complete shipping information for the return of the equipment if other than the operating site.
7. Name of person, and telephone number to contact if questions arise.

B. Enclose the above information with the device and pack the equipment in a commercially accepted container with sufficient packing material to insure that no shipping damage will occur. Mark the container and the purchase order with the RMA number.

C. Your equipment will be tested, repaired, and inspected at the factory. Normal factory turn-around time is fifteen working days or less (excluding shipping time).

D. For emergency service or repair status information please contact the appropriate RiS Customer Service Department or your local RiS Representative.

Ship Equipment to the appropriate location:

Attention: REPAIR DEPARTMENT

ROCHESTER INSTRUMENT SYSTEMS, INC.
255 North Union Street
Rochester, New York 14605
(716) 263-7700 Telex: 978457 RiS Roc NY
Fax: (716) 262-4777

ROCHESTER INSTRUMENT SYSTEMS, LTD.
Maxim Road
Crayford, Kent
DA1 4BG, United Kingdom
[+44] 322 526211 Telex: 27831 Fax: [+44] 322 51208

ROCHESTER INSTRUMENT SYSTEMS, LTD.
915 Kipling Avenue
Toronto, Ontario, M8Z 5H4 Canada
(416) 233-6218 Telex: 06-967801 Fax: (416) 233-9166

IN THE FAR EAST:

ROCHESTER INSTRUMENT SYSTEMS
c/o The Getz Corp (S) Sdn Bhd
P.O. Box 234
Singapore 9004
Tel: [65] 475-9777; 475-4148
Telex: 23566 PCPC Fax: [65] 473-1028

ARRANTY—RiS warrants equipment of its own manufacture to be free from defects in material and workmanship, under normal conditions of use and service, and will replace
mponent found to be defective, on its return to RiS, transportation charges prepaid, within one year of its original purchase. RiS will extend the same warranty protectio
ccessories which is extended to RiS by the original manufacturer. RiS also assumes no liability, express or implied, beyond its obligation to replace any component involved.
arranty is in lieu of all other warranties express or implied.

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COMPTON, CA 90220